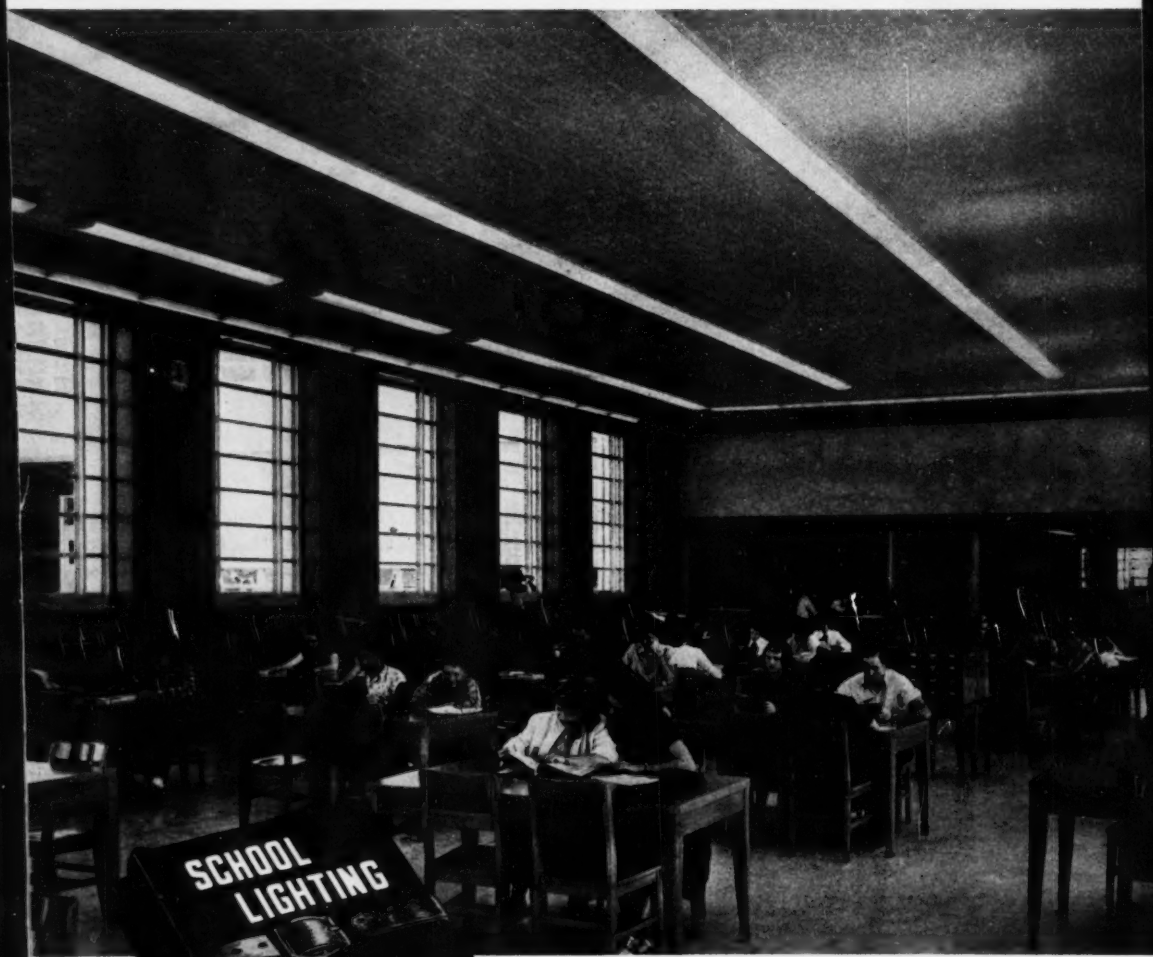
APRIL 23, 1951

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION



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TURBINES STAY "ON THE LINE"

...because TEXACO REGAL OILS (R&O) stay on the job

When *Texaco Regal Oils (R&O)* go in your turbines, out go your worries about unscheduled outages. That's been the experience of operators everywhere. These famous rust- and oxidation-inhibited oils give turbines *full* protection year in and year out.

Sound base stocks give *Texaco Regal Oils (R&O)* their inherent stamina. Then special refining brings them to the quality needed for turbine service. Effective additives inhibit rust and oxidation, and special processing prevents foaming.

Texaco Regal Oils (R&O) thus keep turbines free of harmful rust, sludge and foam . . . assure normal bearing temperatures and instant governor response. Maintenance time and cost are greatly reduced. *Texaco Regal Oils (R&O)* meet the stringent requirements of all leading turbine builders.

A Texaco Lubrication Engineer will gladly show you what *Texaco Regal Oils (R&O)* are doing for others and what they can do for you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

LET'S MEET THE AUTHORS

You'd have a pretty hard time finding two men better equipped to tell the story of EEI's new standards for underground transformers than "Bob" Rung and "Mel" Ghen. Rung is sales manager of distribution transformers for Westinghouse, and Ghen is superintendent of underground distribution for Duquesne Light Co. They've worked together as co-chairmen of the EEI-NEMA Subcommittee on Standards for Underground Distribution Transformers, since 1948.

Except for a hitch in the army which lasted from March, 1918, to

RUNG AND GHEN

October, 1919, Bob Rung has been with Westinghouse ever since he got out of Girard College in 1917. He's been a member of NEMA's Transformer Section since 1943.

Bob's hobby is athletics. ". . . I have in the past actively participated in basketball, baseball, tennis and track," he wrote us. "During 1923 I was athletic director of the Pennsylvania School for the Deaf in addition to my regular activities at Westinghouse."

Bob has a wife and son—his son graduated from Carnegie Tech this year and is now assigned to the Westinghouse Engineering Department at Sharon.

Mel Ghen also saw some military service during the first world war. He was a wireless operator in the U. S. Army Transport Service. After that he graduated from Wentworth Institute in Boston, and joined Duquesne in 1921.

He's been supervisor of operation and technical assistant to the superintendent of overhead, as well as supervisor of construction in underground.

THE EDITORS

Electrical World

Published for 77 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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Here's the

LOWEST COST ARMORED CABLE for DIRECT BURIAL you can buy

HAZARD ARMORTITE

(non-metallic armored)

...and it's service-proved for over 20 years

When you're planning your next underground power cable installation, it will pay you to get the facts and figures on Hazard Armortite Cable. Its low initial cost is a big help today in anybody's budget, but consider the worth of these other timely advantages, too:

1. It's normally carried in factory stock—this means important savings in time for you.

2. Fewer strategic defense materials are required for its manufacture compared to other underground cable designs.

3. It's light in weight, easy to handle, splice and terminate. Armortite can be installed quickly and economically by hand digging, plowing or trenching.

4. Its service record goes back 20 years with never a failure reported due to defect of the cable itself.

5. Its construction is rugged. Long-lived, moisture-resistant Hazard Watertite is the insulation; Okobestoprene Tape (not braid) forms tight seal over the insulated conductors—prevents wicking-in of moisture, safeguards against chemicals; over this construction go tough, leather-like Armortite Tapes, a special plastic sealing compound and saturated jute coverings. The result is an outstanding, long-lived, trouble-free underground cable with remarkable resistance to all enemies of underground cable, particularly mechanical damage.

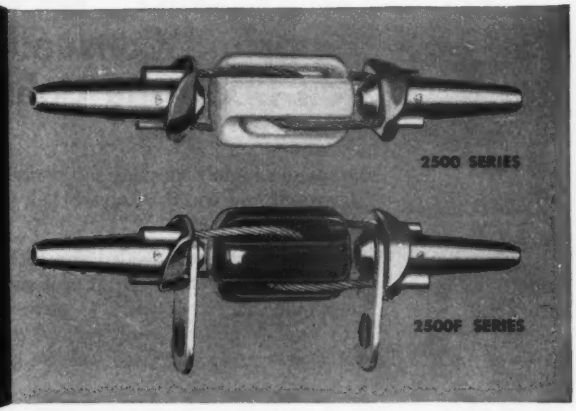
Your Hazard representative will be glad to furnish you complete information, or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD insulated wires and cables for every electrical use

8860

for the largest number of line applications at the lowest possible cost...

USE *Electroline* Insulating Automatic Line Splice SECTIONALIZERS



The Electroline Sectionalizers are assemblies that will function in service as most convenient, reliable and yet low cost interrupting devices. Series 2500-F and 2600 provide for paralleling with a fuse element for further protection when sectionalizing. The mechanical strength of these assemblies exceeds in all cases the rated breaking strength of the conductor for which they are adapted.

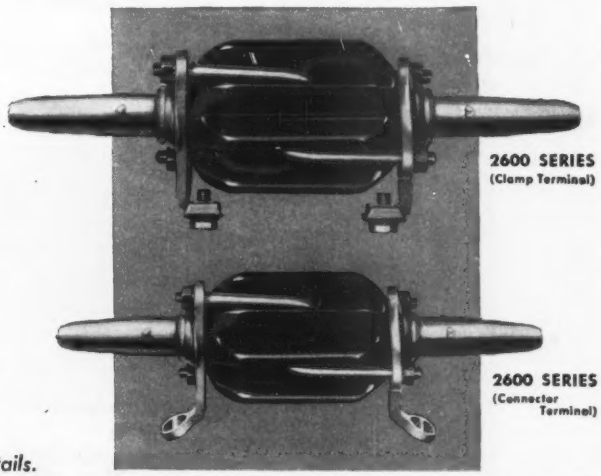
These Insulating Automatic Line Splice Sectionalizers are ideal for:

Installing Regulating Equipment,
simplifies cutting-in disconnecting points, fuses, voltage regulators and series capacitors;

Restoring Service,
providing points to test for trouble;

Sectionalizing Networks,
to readily isolate and test the area in trouble;

Series Street Lighting,
simplifies cutting-in series street lamps—merely cut the line and insert conductor ends into sectionalizer.



Send for Bulletins containing complete details.

TALENT TO ORIGINATE E ABILITY TO PRODUCE

Electroline Company

4121 South La Salle Street • Chicago 9, Illinois

In Canada: POWERLITE DEVICES, LTD., TORONTO

TOTALLY ENCLOSED 22 KV

Supplant Conventional Open Designs on Duquesne Light Company Systems

Duquesne Light Company for many years urged the development of an arc-free air switch that could be metal-clad, yet capable of interrupting load and charging currents at 22 KV.

Such a switch was needed for their 22 KV loop and double tap systems to permit the total enclosure of unit substations, successive steps towards which had been taken in recent years, as pictured here, by enclosing the secondary switchgear and by placing underground the secondary, then the primary connections. All that remained exposed was the primary switchgear.

Following the S&C development of 23- and 34.5-KV interrupter switches, the metal-clad switchgear unit shown on the right was designed jointly by Duquesne Light Company and S&C. The result is the totally-enclosed 2000 KVA unit substations shown below, on which they comment:

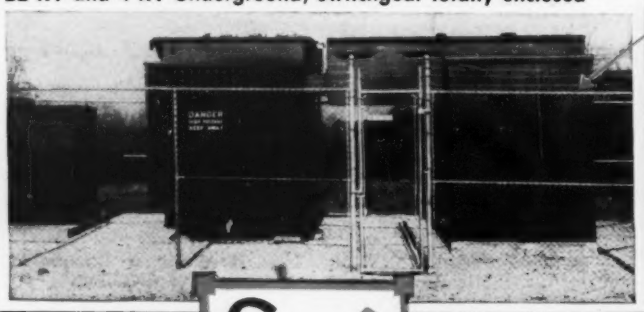
> **"It was found . . . because of the proximity of various hazards, small sites, and safety against external interference . . . that the totally enclosed job permits a satisfactory and safe installation that might have to be located elsewhere if these features had not been developed. In fact, the totally enclosed job will be used in all future installations with few, if any, exceptions."**

S&C Metal-Enclosed Switchgear, using Alduti Interrupter Switches and Type SM Power Fuses, probably offers many advantages for your system also, including low original and maintenance costs. Your inquiry is invited.

The details of Duquesne Light Company's unit substation program are presented in a paper entitled "The Application of Unit Substations" by W. P. Holben and G. N. Hoffman. Copies will be sent on request.

1950

22 KV and 4 KV Underground; switchgear totally enclosed



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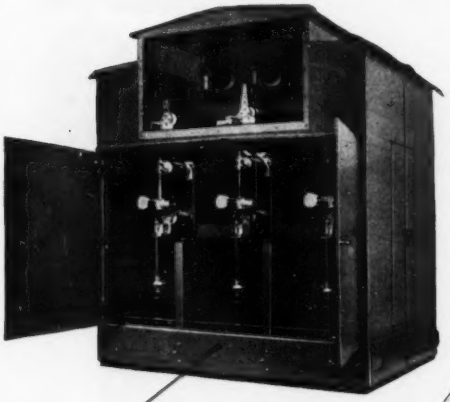
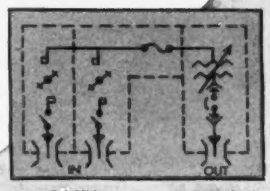
S&C ELECTRIC

Formerly SCHWEITZER & CONRAD, INC.

SUBSTATIONS



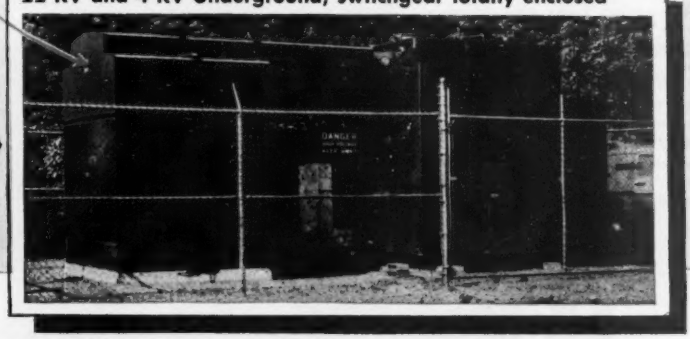


1947
22 KV and 4 KV Overhead

1948
22 KV Overhead, 4 KV Underground

1949
22 KV and 4 KV Underground

1950
22 KV and 4 KV Underground; switchgear totally enclosed



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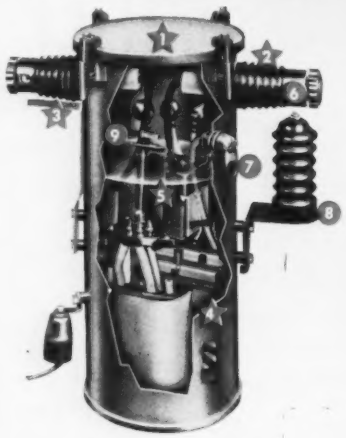
COMPANY

4421 Ravenswood Avenue
Chicago 40, Illinois, U. S. A.

In Canada, Powerlite Devices, Limited, Toronto



1. Completely round tank and cover.
2. Extra rugged bushing with 2-way disconnect clamp and nonbreakable "Enrup" clamping knob.
3. Interchangeable, high-voltage, neutral bushing strap for wye system.
4. New "Coastal Finish" adds years of service life.
5. Inhibited Wemco C-I Oil life increased threefold.
6. Series air gap isolates arrester from line voltage.
7. New breaker handle with emergency control.
8. New wall-mounted, porcelain-clad De-ion arrester with high surge current capacity.
9. Tap changer handle located above oil level.

"CSP" Transformer RW Tank
5,000 volts and below
100 kva and smaller

They're NEW!

5 More Features that cut maintenance

Five great improvements in the Westinghouse "CSP®" Transformer:

1. **New round tank**
2. **New high-voltage bushing**
3. **Simplified stocking**
4. **New "Coastal Finish"**
5. **Inhibited Wemco C-I Oil**

Now the "CSP" Transformer cuts distribution costs even more. Like all Westinghouse "CSP" (Completely Self-Protecting) Transformers, the new Model "RW" has both thermal and lightning protection built in.

★ **The completely round tank** provides the most effective seal possible . . . allows more free working space between transformer and pole.

★ **New rugged high-voltage bushings** are 3 times stronger . . . leads are easier to connect and tighten with nonbreakable "Enrup*" clamping knob.

★ **It's convertible.** Stock only Class B-1 transformers for wye systems with a spare supply of arresters. To convert to Class A for Delta systems, remove the neutral bushing strap and replace with a high-voltage De-ion® arrester.

★ **New "Coastal Finish"** provides greater resistance to chalking, cracking and rust. More than doubles protective life of the finish . . . adds years of service before repairing and repainting.

★ **New Wemco C-I (Inhibited) Transformer Oil . . .** greatly increased service life. Low viscosity . . . freedom from acids, alkali, corrosive sulphur and sludging . . . and resistance to emulsification are all maintained at least 3 TIMES LONGER.

Meets ASA and EEI-NEMA standards. Available with cover-mounted bushings, in ratings above 5,000 volts, 100 kva and smaller.

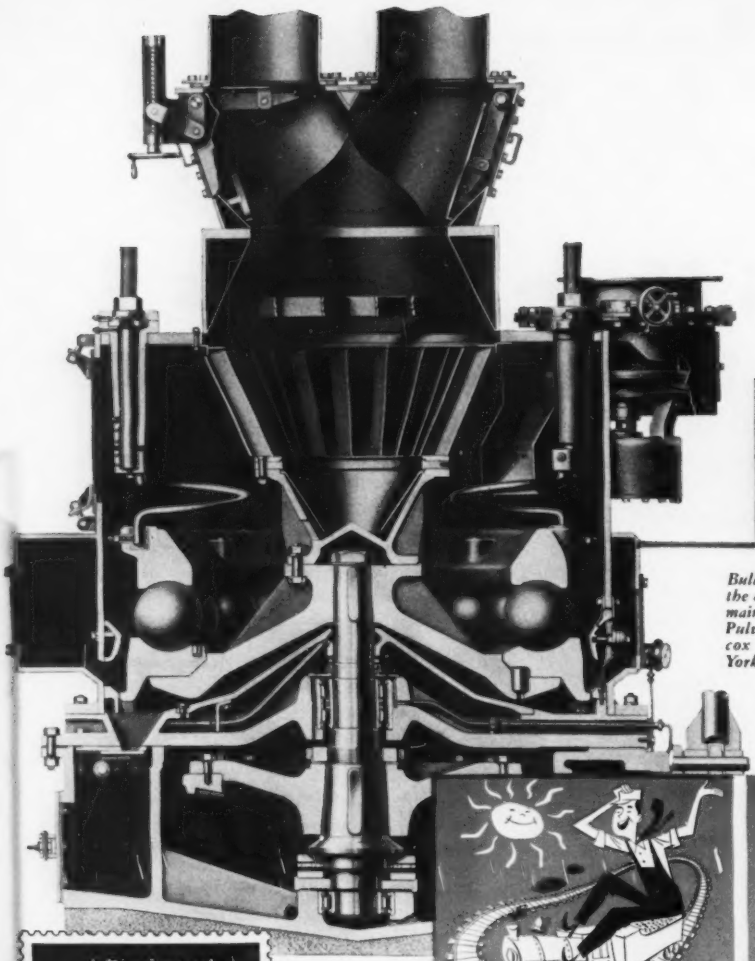
Westinghouse Distribution Transformers are also available in conventional models. For further information call your Westinghouse representative, or write for DB-46-100 "CSP" Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70582

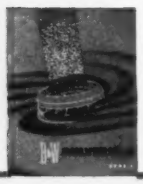
*T. M. Reg. U. S. Rubber Co.

YOU CAN BE SURE . . IF IT'S

Westinghouse

"CSP" DISTRIBUTION TRANSFORMERS





Bulletin G-57 illustrates and describes the design, construction, operating, and maintenance features of the Type E Pulverizer. Write: The Babock & Wilcox Company, 85 Liberty Street, New York 6, New York.

A Product of B&W Engineering for Economy

Recirculating Load—Dries as It Grinds

Recirculation of fines within the mill gives repeated, quick-drying contact with large masses of heated air and metal . . . produces proper fineness at all loads, even with coal as wet as it can get. Fines are classified in the mill.

Uniform Performance Regardless Of Wear

Balls and grinding rings wear together . . . assure uniform fineness regardless of attrition of the grinding elements . . . fineness automatically increases at reduced loads.

A big asset in *low-cost* power generation

The only accurate measure of pulverizer efficiency—*and ultimate cost*—is a function of availability, plus combined materials and labor maintenance per ton of product over long periods of continuous operation. B&W recently surveyed a representative group of utilities, covering a wide geographical area and broad range of coals. More than 100 B&W Type E mills were reported in service from one to ten years, and with aggregate product of 25 million tons:

- Average Availability: 96.5%
- Average total maintenance cost per ton: 3.12 cents

It will pay you to remember this outstanding—and typical—history of dependable, low-cost performance when considering your next pulverizer installation.

Blows Clean Air—Saves Wear and Tear

Unique in pressurized operation, the Type E Pulverizer requires remarkably little maintenance of the primary fan, because it blows only clean air . . . is not subject to the damaging abrasion of entrained particles.

One-Point Variable Fuel—Air Control

Like the accelerator on your automobile . . . assures proper coal-to-air mixture . . . produces desired rate of steam generation over a wide range with coal conditions suitable for sustained high combustion efficiency.

Low Power Consumption

Ball-and-ring grinding, antifriction bearings, pressure lubrication, and automatic rejection of ungrindable materials make possible high output with minimum power demand.

Outstanding Performance Record

Availability and maintenance economy beyond today's most exacting requirements are proved in over 1300 Type E Pulverizer installations.

Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

G-5197

is obsolete wiring

from this

ANACONDA "POWER UP" CAMPAIGN HELPS UTILITIES

HERE IS another advertisement in the Anaconda "POWER UP — And Be Prepared" campaign urging industry to make more efficient use of the power it buys from you. This Anaconda campaign is also being directed to contractors and wholesalers.

As in our previous industry-wide campaigns, we again offer advertisement reprints, imprinted with your letterhead and message —for mailing to your industrial power customers.

the right cable for the job

reducing your power

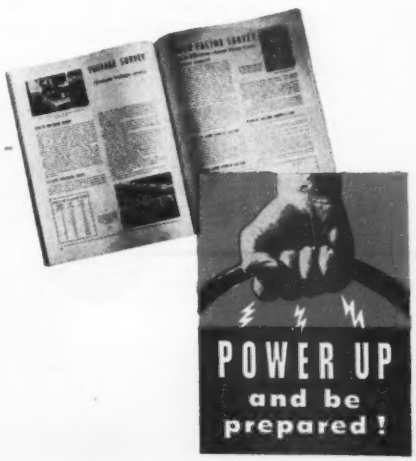
to this?

SURVEYS SAY, YES! Overloaded circuits and inadequate electrical equipment are stealing power and profits from 9 out of 10 industrial plants—a fact established by industrial surveys.

UTILIZE THE POWER YOU PAY FOR. Obsolete wiring systems cut down production . . . lose valuable man hours . . . and weaken the potent industrial power that is so vital to the strength of our national defense.

POWER UP AND BE PREPARED for greater production, lower costs and a stronger national defense. Call in your utility, consulting or plant power engineer or your electrical contractor. Find out the condition of your plant wiring system today and prevent a possible breakdown tomorrow.

AND DON'T FORGET to send for your copy of *"Power Up—And Be Prepared,"* a straight-to-the-point guide to wiring systems and maintenance. It helps you effectively survey your own wiring system. Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.



ANACONDA®

WIRE AND CABLE

NOW... practical, low-cost demand metering of even small kw loads!

SINGLE OR POLYPHASE CIRCUITS

To help you achieve all-important economy in the metering of kw demand, Westinghouse continues to develop and improve devices for every application in this field. The result is . . .

A complete line of kw demand type equipment . . . one that fulfills all of your present needs and anticipates many of your future requirements!

The improved CSH single-phase meter and the new CSH-8 polyphase unit (illustrated here) are typical examples of the way Westinghouse pioneers to produce savings for you. Into the CSH meter have gone many new improvements to make it easier, and more practical for you to measure demand on single-phase loads. And the new CSH-8 is the first thermal demand unit available in a socket base for polyphase circuits. Both units combine standard watthour meters with practical thermal demand meters—in a single case—to answer your need for low first cost . . . lower installation and maintenance costs.

In the complete line of Westinghouse metering equipment you'll spot many opportunities for savings. So whether your needs involve large loads or small, single or polyphase circuits, kw or kva, call on Westinghouse.

For complete information on CSH Meters write for Catalog Sections 42-337 and 42-338. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40394

YOU CAN BE SURE.. IF IT'S Westinghouse METERS

NEW!

Type CSH-8 socket-type, combination watthour and thermal watt demand meter for polyphase circuits.

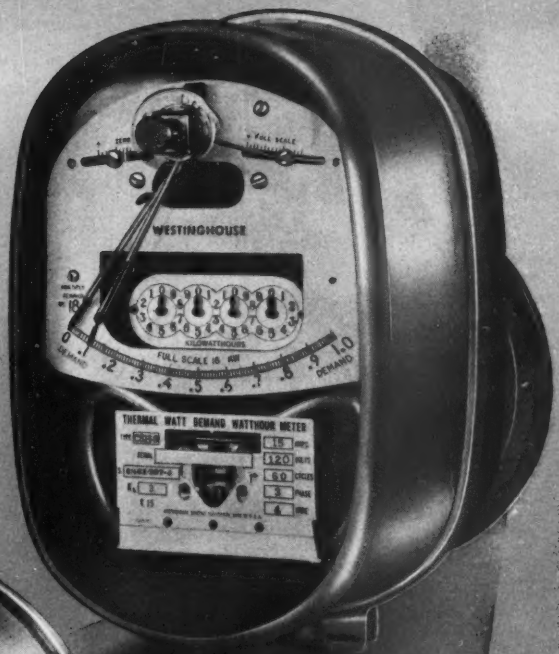
SIMPLIFIED INSTALLATION One mounting for both watthour and thermal demand meter.

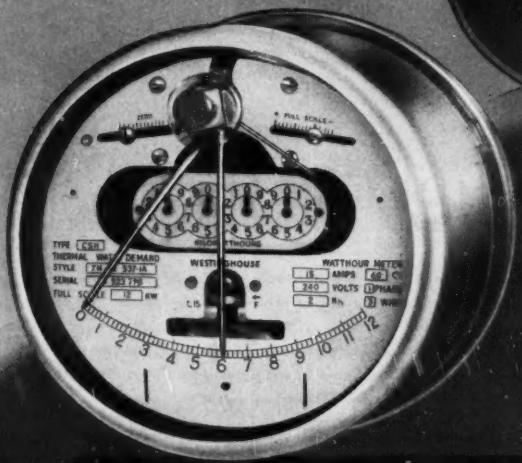
LOW MAINTENANCE Simple thermal action provides same low-maintenance characteristics as standard watthour meters.

MINIMUM SIZE Over-all dimensions are the same as for a three-element watthour meter except for the increased depth of the demand-type cover.

IMPROVED!

Type CSH combination watthour and thermal demand meter for single-phase circuits. Now available —high-capacity, 50-ampere, 240-volt, 48-kw demand.





THERE'S A WESTINGHOUSE METER FOR EVERY APPLICATION!

Recording kilowatt demand meters.

Block interval, indicating and accumulative demand registers.

Single or polyphase combination watthour and thermal watt demand meters.

Switchboard-type combination thermal watt demand meters.

Greater Savings . . . . . .

through Simplified Design in Cope Cable Trough Installation

Cope

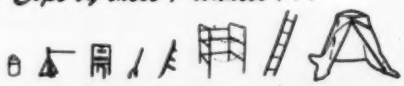
To save material is of the greatest importance to our Defense Effort. We daily read of cuts in allotment of materials for "non-essentials." And when essential equipment—such as Cope Cable Trough—saves material, not only our government but naturally all industry is interested. That's why so much Cope Cable Trough is being used by outstanding Utilities, Industrial plants and Government agencies.

By using standard Cope Cable Trough and Fittings—turns, branches, reductions, vertical as well as horizontal runs that can be so easily assembled—waste of materials during installation in the field are eliminated. For the same reasons, countless man-hours are saved in installation time.

If unusual problems of installation arise, the Cope Engineering Staff is at the service of customers to help design special fittings.

Since it is the duty of everyone to conserve—and since Cope Cable Trough saves material, labor and costs—you will want a copy of our latest Bulletin describing Cope Cable Trough. Won't you write for it today?

You know Cope by these Products . . .



T. J. COPE, INC., 711 SOUTH 50th ST., PHILADELPHIA 43, PENNSYLVANIA

CHICAGO PLACES RECORD ORDER for TROLLEY COACHES

Trolley coaches and Chicago are old friends—and good friends too!

When this record-breaking order of 349 new coaches is delivered, Chicago will be the biggest operator of these modern electric vehicles in the country.

Successful experience played a major part in CTA's decision to order this record number of electrics. This experience dates back more than 20 years—back to the pioneer days of trolley coach operation.

But, the "pioneer" days are long since gone. Today trolley coaches, combining the best features of electric vehicles and motor buses, are operating successfully in 67 cities throughout the country. ***General Electric Company, Schenectady 5, N. Y.***

GENERAL ELECTRIC

GEORGE H. WAHN CO.

Everything Electrical

"Wahnco" Specialties

99-105 HIGH STREET corner of CONGRESS STREET

BOSTON 10, MASSACHUSETTS

WHOLESALERS OF ELECTRICAL MERCHANDISE AND APPLIANCES
CENTRAL STATION AND CONTRACTORS' SUPPLIES

October 6, 1950

Remington Rand Company
140 Federal Street
Boston, Massachusetts

Gentlemen:

Since installing the Remington Kardex Graphamatic System eighteen months ago for our Perpetual Inventory, I have found this visible card index has resulted in a great saving of time by the operators, and of money for the firm.

One of the things I like about it is the ease with which a complete list of customers' back orders can be kept by using the Back Order Card. The visible picture of the inventory turnover, without studying each card, has resulted in greatly increased merchandise turnover, and savings in warehouse space. Both of these have eased the financial problems in carrying a proper inventory.

Your system has proved very effective and all connected with its operation are highly pleased. The assistance given us by your representative, Mr. Charles Featherston, and his co-workers was invaluable in starting and operating this system effectively.

Cordially yours,

R. Irving White
Supervisor

RIH/jm

All these savings, plus 2 Warehouses instead of 3!

Before George H. Wahn Co. installed their Kardex Inventory Control, they needed three warehouses. Today they operate efficiently with only *two.*

Impressive savings like this, together with faster turnover and lowered clerical costs, are common wherever Kardex takes over Inventory Records. For Kardex gives realistic and speedy *control* of inventory. The visible signals automatically flash reminders you can't ignore, in ample time to take necessary action. You can find all the facts on this flexible, cost-cutting system in Booklet KD 375. Send the coupon today for your free copy.

Management Controls Reference Library
Room 1032, 315 Fourth Avenue, New York 10

Gentlemen: Yes, I would like to have your Booklet KD 375 "How to Make Profits from Inventories."

NAME_____

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Remington Rand INC.

LOCKE

presents masterpieces of

insulator engineering

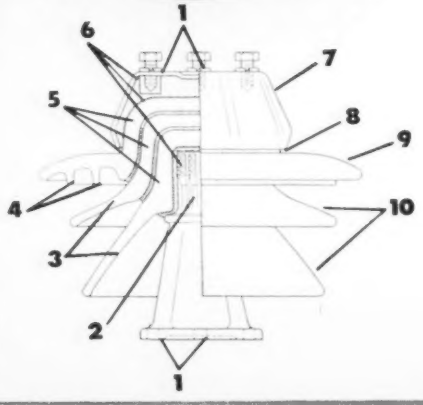
Switch to
LOCKE SWITCH & BUS INSULATORS
typified by

No. 7785

shown above . . . and first introduced by Locke in 1920 as the worthy successor to the industry's first high voltage switch-type insulator . . . originated by Locke in 1911. Today No. 7785 is probably the best known of Locke's large family of Switch & Bus Insulators . . . every member of which you'll find is a masterpiece of engineering in its own right. Always specify them.

Presenting **A MASTERPIECE OF INSULATOR ENGINEERING**

The LOCKE high voltage Switch Insulator



LOCKE DESIGN gives you ALL these advantages

1. Precision assembly jigs maintain positive alignment between tapped holes in the cap and bolt holes in the pin (or base). The top of the cap and bottom of the pin are parallel to within .015-inches. Such accuracy means easy assembly of switches or other apparatus mounted on them.

2. Vertical ribs on the inside of the caps and the outside of the pins provide high torsional strengths.

3. The Locke wet-process porcelain body—the toughest known—has been a standard of comparison since 1893. It is fully capable of withstanding power arcs, lightning flashovers and extremely rough handling.

4. The contours of the corrugations are such as to give maximum resistance to mechanical impact consistent with total weight and balanced electrical characteristics. The depth of the corrugations assure full leakage distance.

5. Locke Compression Sand at the cement joints adds to strength, and the stability of that strength, throughout the life of the insulator.

6. Non-hardening, resilient coatings, applied to all unsanded, load-carrying surfaces, distribute loading efficiently and act as expansion joints under temperature changes. This contributes to longer life.

7. Galvanizing is done by the exclusive Locke Permazinc process—a quality-controlled, double hot-dip method that assures the highest degree of resistance to weathering and corrosion.

8. In assembly the lower edge of the cap is held positively away from the porcelain. This provides an expansion joint which prevents thermal changes from causing high internal stresses in the insulator.

9. Compression Glaze—a Locke development—assures high resistance to damage from thermal shock or mechanical impact. This means that Locke insulators can be handled faster in construction without danger of chipping or breaking.

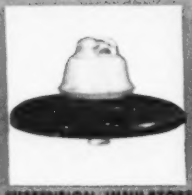
10. The uniformly smooth glazed surface assures easy natural cleaning by wind and rain, and aids the insulator in maintaining its originally excellent electrical characteristics.

YOU ARE EQUALLY SURE of masterpieces of design when you specify other products in the complete line of Locke Insulators and Suspension Hardware. Each pays off in superior performance on transmission and distribution lines, generating stations, sub-station and electrical apparatus.

LOCKE
INCORPORATED
BALTIMORE • MARYLAND

LOW VOLTAGE PIN TYPE INSULATORS

HIGH VOLTAGE PIN TYPE INSULATORS


SUSPENSION INSULATORS

SWITCH & BUS INSULATORS

SPOOL INSULATORS

GUY INSULATORS

LIQUID-FILLED BUSHINGS

SUSPENSION & STRAIN CLAMPS

SUSPENSION HARDWARE

for Dynamic
or Static Stress Analysis
New, Low Cost

Portable Polariscope

Formerly the apparatus required for either visual or photographic observation of photoelastic stress . . . either static or dynamic . . . was cumbersome, very expensive, excessively bulky and heavy.

The recently announced G-R Type 1534-A Polariscope, with its associated STROBOLUME high-intensity light source, has made possible the elimination of all of these difficulties. Formerly, photographic exposures ran into minutes; the bench set-up accordingly had to be carefully designed to minimize vibration in its many parts. The G-R Polariscope consists of an assembly of light rods, supports and disc mounts, this lightness being made possible through the 40-microsecond exposure provided by the STROBOLUME.

The G-R POLARISCOPE FEATURES

★ *Unusually large field of 8 inches.*

★ *Very simple means for making instantaneous photographs of dynamic stresses . . . requires only standard camera with f/4.5 lens.*

★ *Time exposures no longer necessary . . . the* STROBOLUME*'s flash duration is only 40 microseconds . . . unusually short wavelength light . . . very high sensitivity.*

★ *Complete portability . . . weighs only 32 pounds . . . quickly assembled and dissembled . . . ideal for lectures and other demonstrations.*

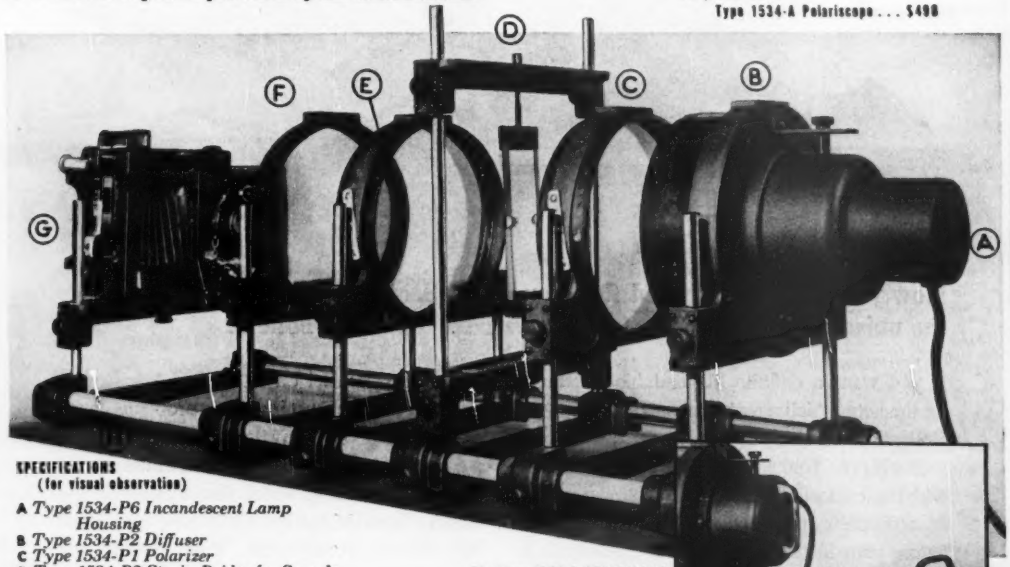
★ *Easily removed quarter plates and polarizers.*

★ *Simplified replacement of damaged elements . . . snap-in assembly.*

★ *Convenient to use . . . horizontal and vertical adjustments over wide ranges . . . simpler than an optical bench.*

★ *Very low cost.*

Type 1534-A Polariscope . . . $498

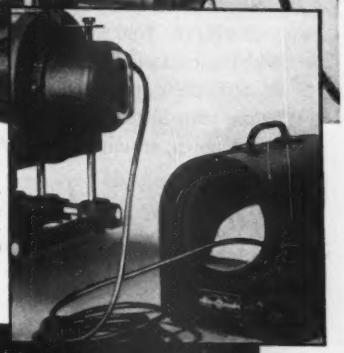


SPECIFICATIONS
(for visual observation)

A *Type 1534-P6 Incandescent Lamp Housing*
B *Type 1534-P2 Diffuser*
C *Type 1534-P1 Polarizer*
D *Type 1534-P3 Strain Bridge for Sample*
E *Type 1534-P1 Analyzer*
F *Type 1534-P5 Filter*
G *Type 1534-P4 Camera Bridge (Camera not supplied)*
H *Type 1534-P7 Shafts (furnished 36 inches long)*

(Accessories required for photography)

A Type 1532-A STROBOLUME. *Standard camera, preferably with ground-glass focusing, with f/4.5 or faster lens. Wratten No. 75 front-of-lens filter recommended to reduce effects of normal room lighting.*



The Type 1532-A STROBOLUME

in place, with its power supply at the right. One knurled nut readily removes the STROBOLUME *lamp for substitution of the standard lamp for incandescent visual observation.*

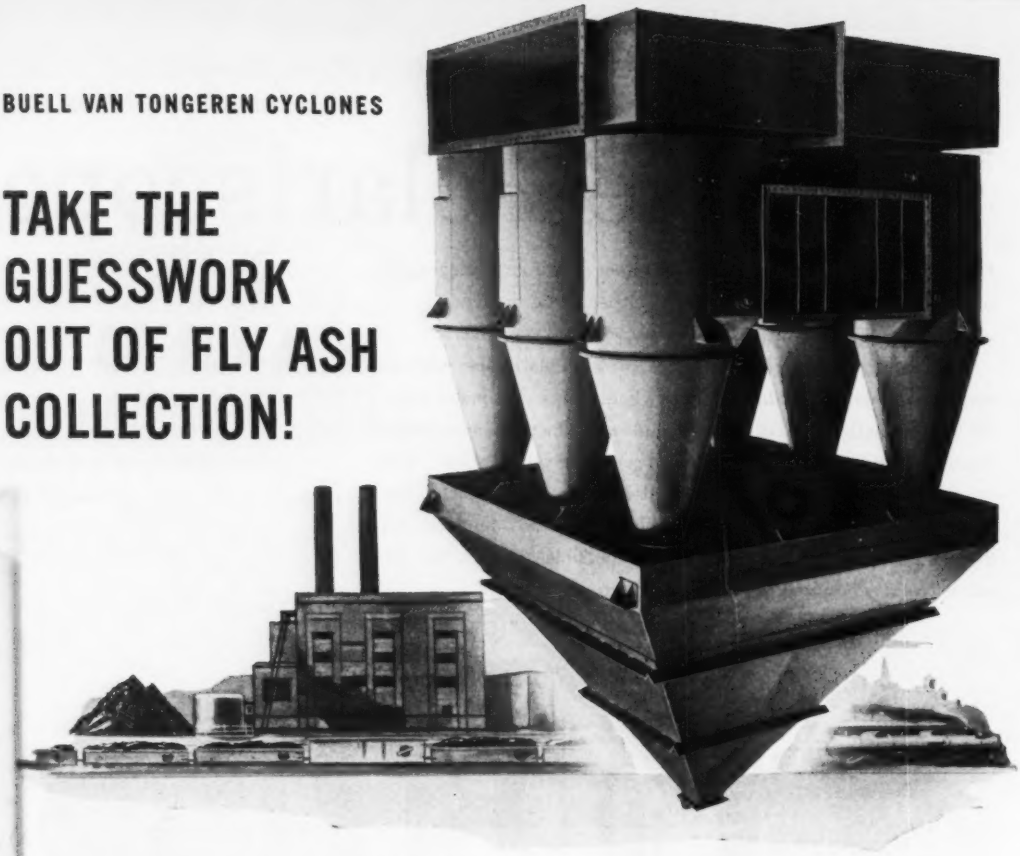
TYPE 1532-A STROBOLUME . . . $245

GENERAL RADIO Company
275 Massachusetts Avenue, Cambridge 39, Mass.

90 West Street NEW YORK
920 S. Michigan Ave. CHICAGO
1000 N. Seward St. LOS ANGELES

BUELL VAN TONGEREN CYCLONES

TAKE THE GUESSWORK OUT OF FLY ASH COLLECTION!



Now you know beforehand that you can collect the nuisance-size particles from pulverized coal-fired boilers.

If you want a definite, dependable statement on the actual 'delivered' efficiency of a Fly-Ash Collection System, ask Buell.

Buell's van Tongeren Cyclone Dust Collector, with Guaranteed Fractional Efficiency, gives you an accurate estimate of collector performance *before* your installation is made. Guesswork is out! Known, sustained peak efficiency is in!

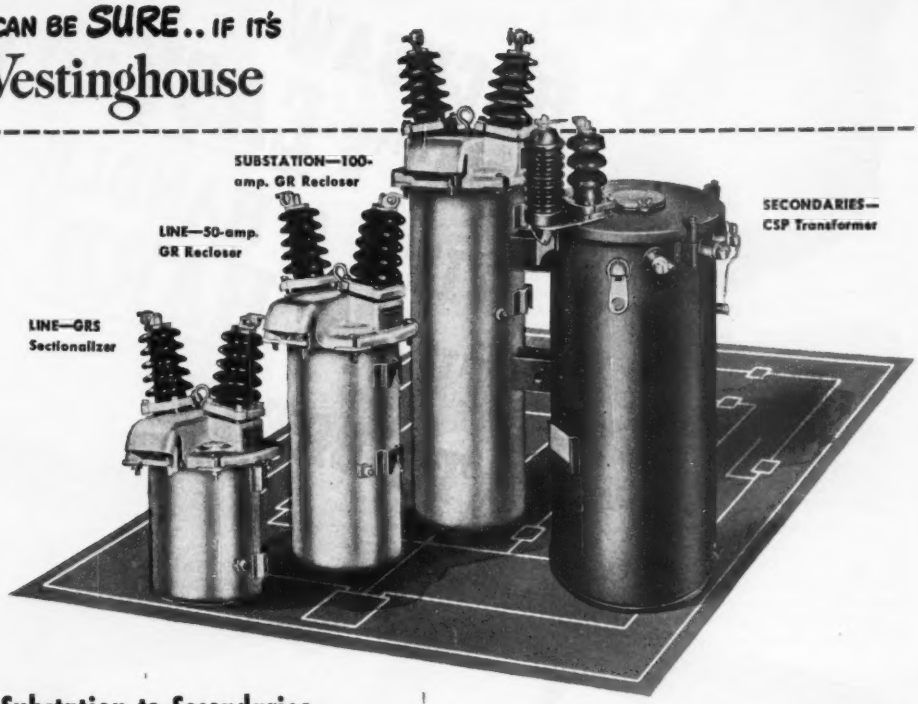
For sound counsel on either Fly-Ash Collection or Valuable Dust Recovery problems, Buell engineers can prove invaluable. Write today for a consultation without obligation, or ask for the latest Buell catalog which discusses Buell Cyclones, Low-Draft-Loss Collectors, and Buell 'SF' Electric Precipitators. Buell Engineering Co., 70 Pine St., Suite 5050, New York 5, N.Y.

buell

Engineered Efficiency in **Fly Ash Collection**

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



From Substation to Secondaries...

COMPLETELY MECHANICAL SYSTEM PROTECTION

...for lower, long-term distribution costs!

In this case, "mechanical" means a *fuseless* protective system... and one which promises many long-term, cost-saving advantages for rural and suburban lines. Specifically, it's a system which eliminates fuse replacement costs; which stays in proper co-ordination *permanently;* which simplifies the job of re-energizing faulted lines.

Its basic elements are those pictured above. The new Westinghouse GRS Sectionalizer, which is used in place of fuses, is its key component. Co-ordinated with substation reclosers, line reclosers and CSP Transformers, the sectionalizer permits—for the first time—attainment of a completely automatic, mechanical protective system... a *sure* way to gain this important objective:

The highest degree of service continuity at the lowest long-term cost!

The mechanical protective system is one of those analyzed in Booklet B-4700, which covers advantages, limitations and cost considerations of all types of protective schemes for rural and suburban lines. For your copy of this practical guide to better protection planning, write: Westinghouse Electric Corp., P.O. Box 868, Pittsburgh30, Pa.

J-60738

Westinghouse
DISTRIBUTION
APPARATUS

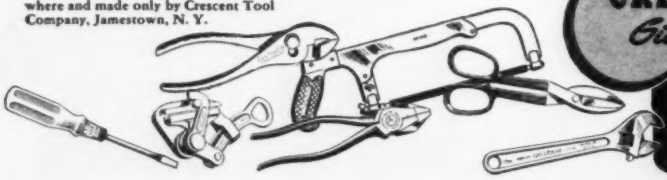
HACKSAW THAT'S EASY TO USE WITH A HANDLE THAT'S HARD TO BREAK!

● To the experienced mechanic the "feel" of a tool is important. The Crescent #1049 Hacksaw has a molded-to-the-hand Neoprene handle that is a great improvement over metal. For one thing, it takes a lot more abuse. It is comfortable and resilient to hold and has high dielectric value. The frame has all the expected Crescent Quality features...made of heavy gauge steel...nickel-plated for corrosion resistance ...beautifully balanced. You'll find all the features that make a good hacksaw in this Crescent model.

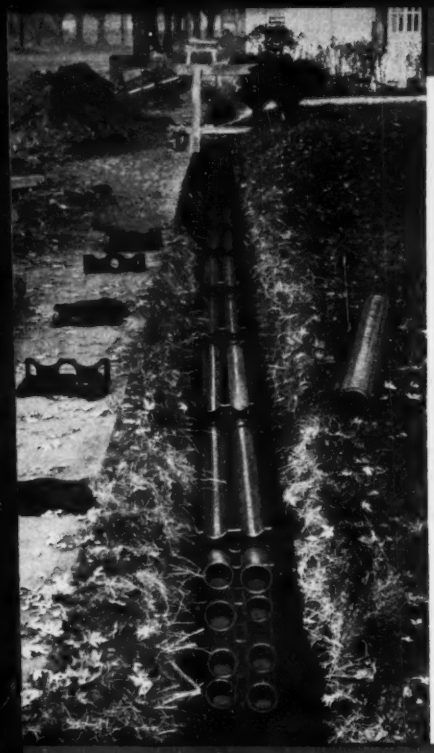
CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

EASY ON THE HAND AND HARD TO BREAK
Feel it . . . it's warm and resilient to the touch. Drop it . . . it won't break. Use it . . . it is impervious to oil and acids. Temperatures 100 degrees below to 200 above will not affect it. Has high insulating value under all conditions.

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N. Y.



CRESCENT TOOLS
Give Wings to Work
Sign of the Artisan
Symbol of Excellence



for faster underground installations

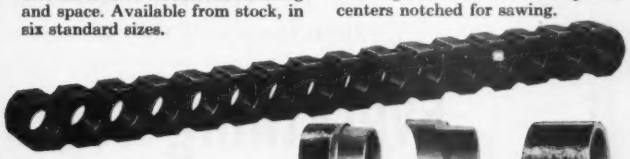
New L-M Spacers

New L-M Base Spacer:

assures rigid foundation, desired gradient. Interlocking ends; wide flat base—the spacer will not tip over during or after installation. All L-M spacers come in standardized cartons to save stockroom handling and space. Available from stock, in six standard sizes.

New L-M Intermediate Spacer:

made of asphalt and asbestos fibre, highly resistant to acids and alkalis, fire resistant, Underwriters' listed. Withstands vertical flat crushing test of over 1200 pounds. Grooved ends lock together with the next spacer; centers notched for sawing.



New L-M Bend Spacer Bar:

a duct-installation leveller, used horizontally or vertically for accurate alignment of conduit around bends. Saves hours of work in lining up. Offers a tremendous saving in installation labor costs. L-M exclusive. 20" long, 1½" square, easily sawed to length.

New L-M Multi-Use Bend Sections and Angle Couplings:

use in any combination to make all kinds of special bends and crossovers. Male and female tapers offset 2½°, giving 5° bend in each section. Smooth inside, watertight tap-tite joints.

The L-M System makes Fibre Conduit *so easy to use*

New L-M Fibre Conduit Vise

An easy, safe way to hold fibre conduit for sawing or tapering. For mounting on truck or bench, or with detachable tripod for use in the field, on the job.

With L-M Fibre Conduit and L-M equipment and tools, L-M's system speeds up underground installations, makes better jobs.

L-M Fibre Conduit is strong, light, tough; yet it's easy to taper and cut to length. L-M base spacers, intermediate spacers, and bend spacers assure a firm foundation and a rigid structure that won't settle or shift.

L-M tools save hours of time in the shop and on the job. Better get the low-down on this high-class, time-saving equipment.

GET THIS FREE HANDBOOK! Pocket-size manual covers recommended underground construction practices; contains valuable reference tables. Ask the L-M Field Engineer for a copy, also for new Fibre Conduit folder; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

New L-M Tapering Tool

Cuts a precise 2° taper on the end of conduit to assure tight, snug joints. Light; easy to use; saves time; cuts costs by salvaging cut ends and short lengths quickly.

36

LINE MATERIAL... Fibre Conduit

Complete Coordinated Equipment for Distribution Today

SAVE TIME...
SAVE SHOPPING...
SAVE SHIPPING...

Get your *complete* street lighting equipment from the source that gives you . . .

Everything for street lighting

SYMMETRIC AND ASYMMETRIC DIRECTOLITE

SPHEROLITE JR.

L-M's FAMOUS SPHEROLITE

CONTROLITE

standards: concrete and metal; all parts and accessories for wood poles and metal and concrete standards.

brackets and mast arms: to meet every conceivable requirement.

luminaires: for mercury vapor and incandescent; all types from the smallest Directolite for outlying areas to the largest Controlite for the brightest white way; metal or porcelain heads, for pendent or side mounting, multiple or series, low or high voltage.

complete control equipment: transformers, relays, accessories—everything you need, including a new truck-mounted service ladder.

L-M lighting engineering service: cooperates with utilities and municipalities to design and recommend efficient, economical installations.

• For complete information about L-M street lighting equipment and service, call your utility company, ask the L-M Field Engineer, or write for bulletins. Address Street Lighting Division, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL . . . Street Lighting

Accuracy...

ONE IMPORTANT REASON WHY
KYLE RECLOSERS OUTSELL ALL OTHERS

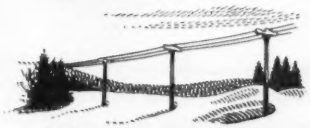
Accurate because they're built that way. Because we make so many reclosers, we have excellent machining facilities, extremely high quality standards and close tolerances, and extensive engineering and field experience. Each recloser is individually tested. The result is a very uniform product that assures accurate coordination.

Precise Hydraulic Mechanism: Does not depend on gravity; no clock-work, coil springs, or mechanical moving parts. A very consistent and accurate timing sequence is maintained. Kyle Reclosers are now supplied with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer oil life.

Greater Convenience: You can change coils and timing sequence right in the field—in a few minutes. No shop trips to change ratings or sequences—it's easier to maintain coordination!

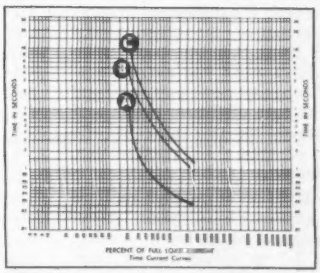
Here's the Kyle type H single-phase recloser. Has all the Kyle safety features. For 2.4 to 15 kv; six ratings from 5 to 50 amps; trip currents 10 to 100 amps; interrupting capacities from 150 to 1200 amps.

Also available in Kyle type 3H three-phase recloser, which recloses and resets individually on each phase to clear temporary faults; but if fault does not clear after three operations, it locks out *all three phases simultaneously* on the fourth tripout.



Satisfactory at wide range of temperatures. The design of the recloser makes it dependable at all temperatures—from 120° above to 20° below, says one user. Another large user, in Canada, says Kyles give complete satisfaction down to 58° below zero.

Thousands of Kyle type H reclosers are installed on rural lines like this in the West.



Wider Choice of operating curves and sequences. Kyle type H is the only recloser that offers three time-current curves—(A) fast, (B) retarded, (C) extra retarded. You can mix or match 'em almost any way you like—seven possible combinations.

'Ask the L-M Field Engineer what others are doing with Kyles. And ask him for a copy of our recloser bulletin. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL
Kyle Reclosers

Complete Coordinated Equipment for Distribution Today

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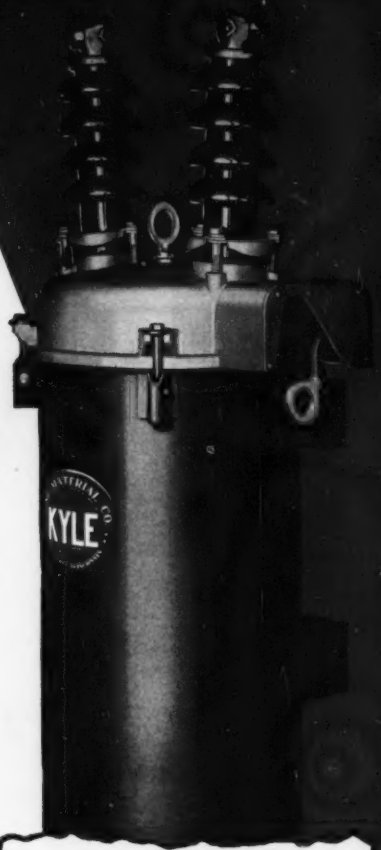
KYLE

TYPE "L" OIL CIRCUIT RECLOSER NOW GIVES YOU UP TO

6000 amps interrupting capacity

IN NEW 140-AMP RATING



First recloser actually engineered for heavy-duty service ... full power-class design ... 110 kv insulation impulse level ... ratings up to 140 amps ... only real heavy-duty recloser in its class

Kyle type "L" reclosers cost a little more than lighter-duty reclosers, but they're worth the difference in service, performance, convenience, and freedom from maintenance. Even if you don't need the extra interrupting capacity now, you will need it to take care of future loads; and in the meantime you enjoy all the benefits of type "L" performance and economy.

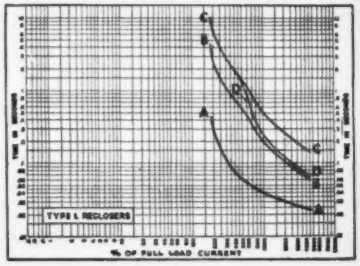
It's the Kyle oil cross-blast method of arc extinguishing, plus heavy-duty design, that makes it possible for the "L" to handle heavy fault currents up to 6000 amps.

The type "L" is the only recloser with so wide a choice of operating sequences. Four standard curves permit any sequence of operation to meet your coordination problems.

Sequence and coil changes are made right in the field—in a few minutes. To change to a coil of different rating, you just remove two screws. To change operating sequence, simply rotate a disc or change one small part. It's quick—and easy! Saves shop trips!

Extremely accurate; virtually no effect from ambient temperature changes. Positive fast operation; positive toggle closing—doesn't depend on gravity. Many safety features: cover and tank electrically dead—bushing tops only live parts; trip-free operating handle. Large sleet hood protects counter and operating handle; may be rotated in 90° steps. Rugged; shock-proof; trouble-free.

ONLY RECLOSER WITH 4 OPERATING CURVES



RATINGS

Coil Rating Amperes	Min. Trip Current Amperes	Maximum Interrupting Capacity Amperes At Maximum Phase-to-Phase Nominal Voltage of		
		4.8 kv	7.2 kv	14.4 kv
25	50	1500	1500	1500
35	70	2100	2100	2100
50	100	3000	3000	3000
70	140	4200	4000	3000
100	200	5000	4000	3000
140	280	6000	4000	3000

Read all about it!

Ask the L-M Field Engineer for a copy of Bulletin CR1A—on the type "L"; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LM

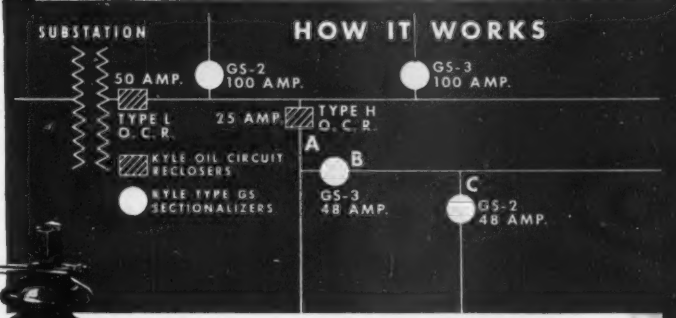
LINE MATERIAL... Kyle Reclosers

Complete Coordinated Equipment for Distribution Today

How to make rural line protection fully automatic...

KYLE

type GS automatic oil sectionalizers



Completely automatic from substation to branch

Sectionalizers coordinate with reclosers to isolate branch lines on permanent faults. They are not current-interrupting devices. They open only while the recloser contacts are open. They are pre-set to lock out after the first, second, or third operation of the recloser.

In the diagram, A is the recloser. B is a Kyle sectionalizer set to open during the *third* operation of the recloser (indicated by GS-3). C is set to open after the *second* operation of the recloser. If a fault occurs beyond C, recloser A operates. If the fault doesn't clear on the first operation, the recloser opens again, and Sectionalizer C opens, isolating the tap. Then the recloser re-energizes the rest of the branch.

If a fault occurs *between* B and C, Sectionalizer C does not operate. But if the fault has not cleared by the third operation of the recloser, Sectionalizer B opens, isolating that branch. The recloser then re-energizes the rest of the line.

Other branches are also protected by Kyle sectionalizers which are opened by the 50-amp type L recloser at the substation.

ALL THE KYLE SAFETY FEATURES

Tank, cover, and operating handle electrically dead. Tank may be grounded. Mechanism cooled, and insulated from tank, by transformer oil. Trip-free operating handle—cannot impart a blow to operator.

RATINGS

Seven sizes, with minimum tripping currents 8 to 100 amps to coordinate with reclosers rated from 3 to 100 amps. Maximum operating currents 150 to 2000 amps, 2.4 to 15 kv. Weight with oil about 25 pounds. Crossarm or direct pole mounting.

***ISOLATES** permanent faults on branch lines...*

***COORDINATES** with any make or type of recloser...*

***COSTS LESS** to operate than fuses...*

The Kyle type GS sectionalizer opens only on permanent faults that the recloser cannot clear; it provides completely automatic protection and positive coordination by eliminating the human element in installing the correct fuse; and while the GS costs more than a single-shot cutout, it saves far more than the difference, in time and service calls.

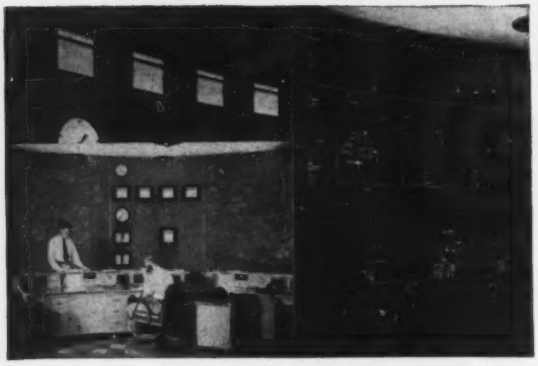
Because sectionalizers do not interrupt current, there is no arc to wear contacts or cause oil contamination. Sectionalizers cannot be used independently, but only with reclosers—of *any* make or type.

Ratings are changed in the field by replacing the trip coil. Lockouts are pre-set by changing the lockout adjustment pin—a matter of a few minutes. After a permanent fault has been corrected, the sectionalizer is manually reset with the operating handle.

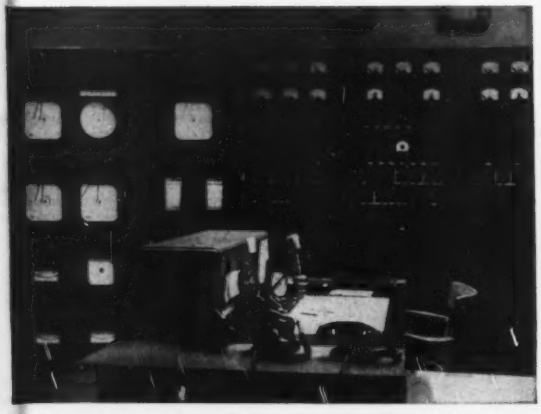
Get the Whole Story

Ask the L-M Field Engineer to explain complete, automatic protection, and to give you a copy of Sectionalizer Bulletin CR3. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL... Kyle Sectionalizers



METAMETER AT BONNEVILLE AND GRAND COULEE DAMS. Bristol strip-chart Metameters are used by the Bonneville Power Administration. The receivers shown above are installed on the Bonneville dispatcher's board at the H. D. Ross Substation, Ampere, Washington, and record Bonneville 230 KV, Bonneville total power, Coulee total power (transmitted from Grand Coulee Dam approximately 250 miles away), and system total power.



METAMETER AT ROCKLAND LIGHT AND POWER COMPANY, MIDDLETOWN, N. Y. The 15 Metameter indicating receivers at right show kilowatts, water levels and kilovars at three hydro-electric power plants. The three at left measure and record pressure of delivered gas, and integrate flow into the Company's distribution system at points up to 50 miles away. The other Bristol instruments totalize flow during a given period of time in the three supply lines and also give a continuous reading and a chart record of total instantaneous flow through all three lines.

DISPATCHING MADE EASIER

Bristol Metameter* telemeters give the dispatcher up-to-minute readings of electrical and other measurements made many miles away

A complete and continuous visual picture of what is happening at key points throughout the system enables the dispatcher to accurately appraise conditions instantly and act with full knowledge.

With information from his Metameter receivers, he can keep in touch with load changes and direct the generation and transmission of power more economically and with greater ease. He can foresee emergencies and take the necessary steps to maintain schedules. Often, he can increase safe maximum loads in tie lines considerably.

Among the types of information Bristol Metameter telemeters make available to the load dispatcher are: the load at each tie-line point, output of each generating station, totalized output (on one instrument) of all generating stations, active and reactive power and power demand at key points, voltage and current at various points.

Generating stations use Metameter for information on output of each associated station (attended or unattended), total output, water level and water wheel gate position, water level in reservoirs, surge tanks, etc.

Readings can be transmitted any distance, over any two-wire circuit or its equivalent, carrier-channel, telephone, telegraph or radio (including microwave) . . . to recording receivers (narrow or wide-strip chart or round chart) or indicating receivers.

Metameter is the tried-and-proved telemetering system. Thousands are in use on all types of service. Write us for Bulletin M1700. THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 20, Conn.

Reg. U. S. Pat. Off.

BRISTOL

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

V.C. CABLE

Roebling Varnished Cambric is your A-1 specification for heat resistance

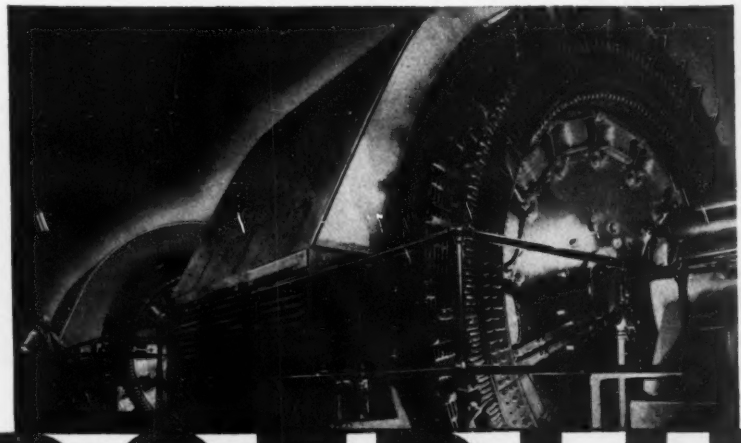
YOU'LL GET maximum dependability... you'll save real time and money... by adopting Roebling V. C. Cable as leads for transformers, generators, motors and oil switches... Roebling V. C. is furnished in single conductor sizes from 2,000,000 C.M. to #14 A.W.G.; in multiple conductor sizes from 750,000 C.M. to #14 A.W.G. It is recommended for use up to 17,000 volts between phases in single or multiple conductor construction; and to 26,000 volts for single conductor grounded neutral.

A big share of Roebling's complete line of electrical wires and cables is required today in the nation's rearmament program, but we shall do everything possible to meet your requirements. John A. Roebling's Sons Company, Trenton 2, New Jersey.

Manufactured with solid conductors or stranded in a variety of strandings, coated or uncoated, according to your needs. Available in single or multiple conductor.

Insulated with varnished cambric tape, in accordance with I.P.C.E.A. and Underwriters' specifications unless otherwise specified by you.

For outside covering you have a choice of braid, for service in dry locations; lead, for service in damp locations; and for aerial use or direct burial we recommend a protective armor such as steel tape or galvanized round wire armor.



ROEBLING

Atlanta, 934 Avon Ave ★ ***Boston,*** 51 Sleeper St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Detroit,*** 915 Fisher Building ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St ★ Export Sales Office, ***Trenton, N. J.***

Standard
TRADE MARK ®

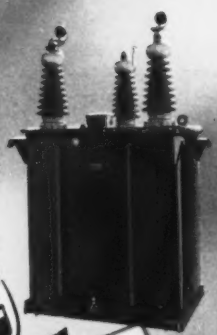
TRANSFORMERS. .

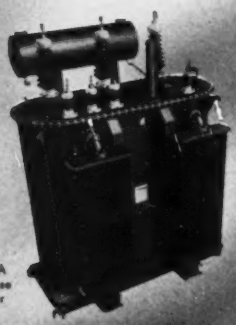
* Dry type load center unit sub 1,000 KVA.

BUILT TO YOUR REQUIREMENTS TO SERVE A SPECIFIC NEED

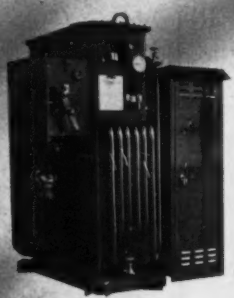
● In addition to standardized designs and types, The Standard Transformer Company has a long established record of engineering and manufacturing transformers exactly suited for specific operations. Our one job, for more than a quarter of a century, has been to produce transformers. There has never been sacrifice of materials, methods or skills in producing Standard's quality product . . . basic construction is unsurpassed. Complete freedom to specify accessory equipment, permits closer adherence to job requirements.

* 69 KV OISC metering set.



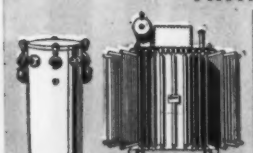


* 3,000 KVA OISC 3-phase 69 KV power transformer.

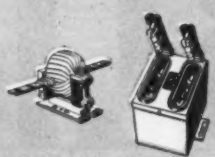


* Askarel load center unit sub 300 KVA.

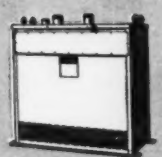
TRANSFORMERS FOR EVERY APPLICATION



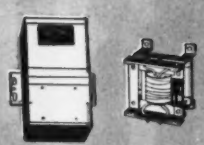
Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)



Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)

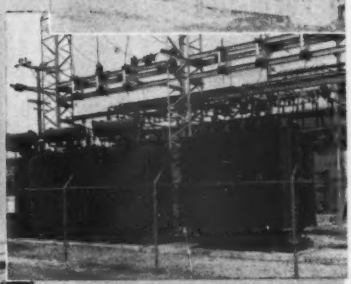
Standard
TRADE MARK ®

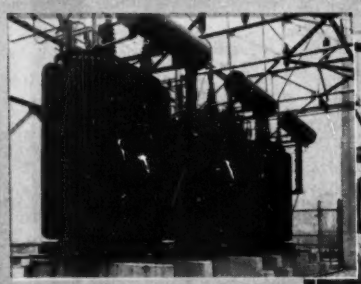
. . . . . ON THE JOB

PROVES SUPERIORITY THROUGH LONG LIFE AND TROUBLE-FREE PERFORMANCE

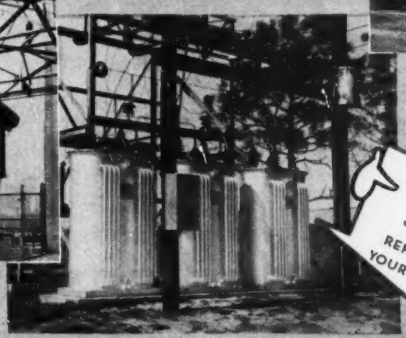
● Hundreds of The Standard Transformer Company's transformers are installed and operating all over the world today, and considerable evidence proving long years of trouble-free service by Standard transformers flows into our offices daily. Factual testimony proving efficient performance is ample. Our engineering staff and production teams are geared to cooperate efficiently with servicing your order. For the complete story — write for our brochure "Standard transformers . . . on the job."

● An installation helping to power atomic research.





● A 15,000 KVA substation, Mill Creek Pumping Station, Cincinnati, Ohio.



● 1,000 KVA Bank at Myrtle Beach, South Caroline.

● Three 2,000 KVA single phase and one 5,000 KVA 3-phase transformers serving a large manufacturing plant in the Midwest.

THE Standard TRANSFORMER CO.
TRADE MARK

WARREN . . . OHIO

(REPRESENTATIVES IN PRINCIPAL CITIES)

No substitute here for EXPERIENCE

— in men and materials!

Specialized knowledge is an important part of any job. Make certain of tape quality by specifying Accurate — the tape with over 30 years experience behind its manufacture!

ACCURATE TAPES

...for every INSULATING need!

ACCURATE RUBBER TAPE

Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M.-A.A.R. grades.

ACCURATE FRICTION TAPE

High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M. grades.

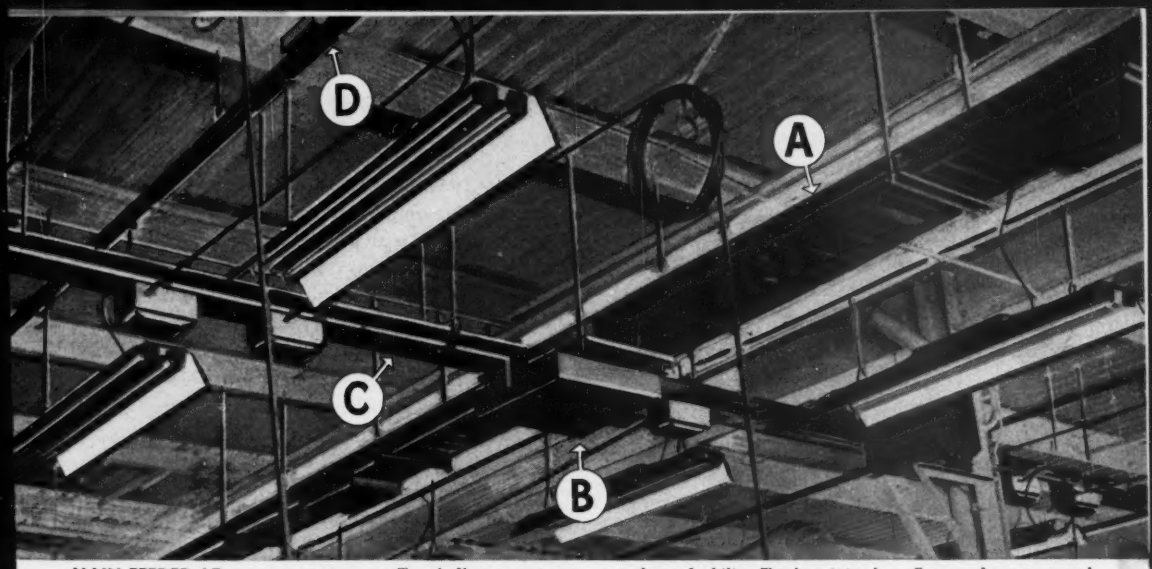
ACCURATE
Plastic Tape

Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

...no finer tapes at any price!

For big wiring jobs or small, Accurate is the choice for positive tape protection. Both friction and rubber are strong, pliable, easy to apply. Accurate tapes make accurate wraps — pull tight and clean over irregular surfaces. When you order tape, mention Accurate by name. It's the one sure way to complete tape satisfaction. For a complete guide to tape selection and tape buying, ask for the new Accurate Data Folder. Accurate Mfg. Company, Garfield, New Jersey — address inquiries to Dept. D.

amc



MAIN FEEDER AT SEALED POWER CORP. Trumbull LVD FLEX-A-POWER high-capacity feeder (A) distributes power through plant with minimum voltage loss. Can be dismantled, relocated with complete salvability. Tap box (B) takes off power for FVK secondary feeders (C). 600-4000 amperes. LTG (D)—see below—is used for lighting. Bulletin TEB-1.

SECTIONALIZED POWER FEED

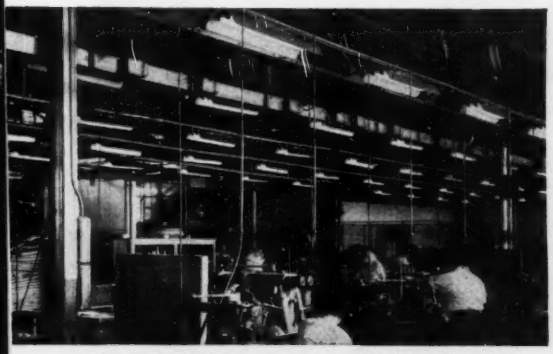
is ready for quick conversion

No plant... few buildings... can foretell what its power requirements will be months—or days—ahead.

But with FLEX-A-POWER® handling the electric power distribution from main switch or breaker to machine or lamp... any new requirement, additional load or rearrangement of load, can be easily met.

This system of standard-section busways gives utmost flexibility in power take-off, and, if necessary, can be taken apart for quick relocation. Easier to install than wiring and conduit—and more economical—it is ideal for a period when emergencies may develop, when conversion may be necessary.

Write us for literature on the types that interest you.



SECONDARY FEEDER AT PESCO PRODUCTS Division of BORG-WARNER CORP. Nearly ¾-mile of 600 amperes, 440 volt Trumbull FVK FLEX-A-POWER takes power from a panelboard in parallel runs over entire area. 15 outlets to each 10-ft. section. No expensive rewiring needed when relocating loads. Can also be easily dismantled and re-installed. 225-1000 amperes. Bulletin TEB-4.

LIGHT-DUTY BUSWAY AT PESCO PRODUCTS Division of BORG-WARNER CORP. Use of LTG FLEX-A-POWER to distribute power to tools and lighting fixtures permits quick changes in machine layout without delay for rewiring. Busway can be tapped *at any point* by plug or trolley—every inch an outlet. Rated 50 amperes. Bulletin TEB-2.

TRUMBULL (T) ELECTRIC

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

Finest Buy in the Land . . . on *Every* Count!

NEW 1951 CHEVROLET

Advance-Design

TRUCKS

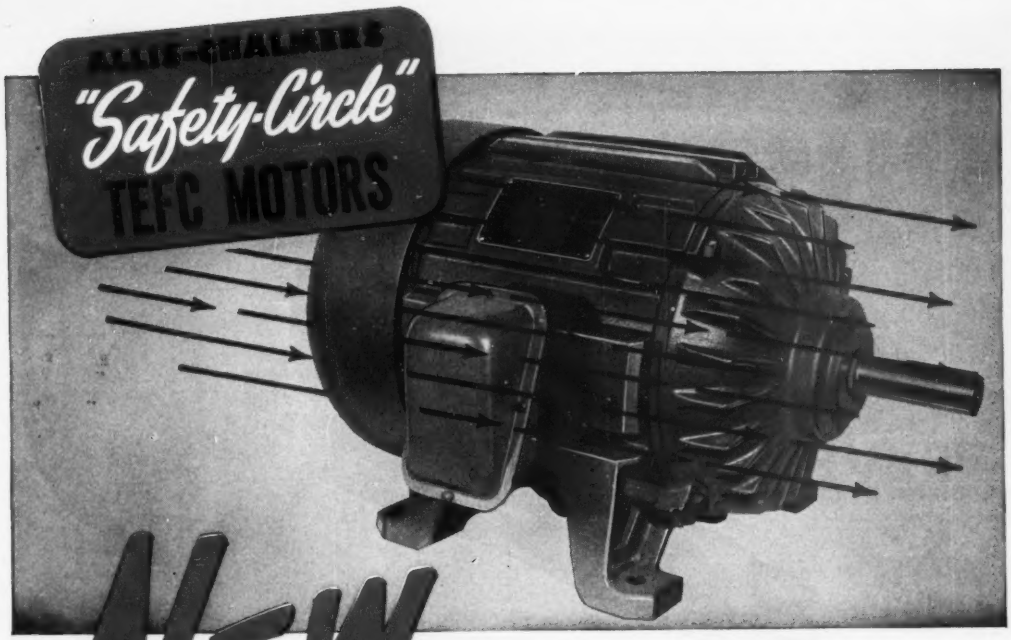
These new 1951 Chevrolet trucks are tops in value. They're tough and rugged. They're loaded to the brim with power. They're thrifty . . . move massive loads . . . handle like no other truck. Chevrolet's latest haulers have 51's finest new features, too. Features like new, super-effective brakes that are extra-safe and easy to operate. Features like Chevrolet's Dual-Shoe parking brake, Chevrolet's new Ventipanes and new cab seats that bring you comfort with a capital "C." Visit your Chevrolet dealer and look over these great new trucks. You'll find the right truck for *your* job!

CHEVROLET MOTOR DIVISION, *General Motors Corporation*
DETROIT 2, MICHIGAN

CHEVROLET

ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the 105-h.p. Loadmaster or the 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • **POWER-JET CARBURETOR** — for smooth, quick acceleration response • **DIAPHRAGM SPRING CLUTCH**—for easy-action engagement • **SYNCHRO-MESH TRANSMISSIONS**—for fast, smooth shifting • **HYPOID REAR AXLES**—for dependability and long life • **NEW TORQUE-ACTION BRAKES**—for light-duty models • **PROVED DEPENDABLE DOUBLE-ARTICULATED BRAKES**—for medium-duty models • **NEW TWIN-ACTION REAR BRAKES**—for heavy-duty models • **NEW DUAL-SHOE PARKING BRAKE**—for greater holding ability on heavy-duty models • **NEW CAB SEATS**—for complete riding comfort • **NEW VENTIPANES**—for improved cab ventilation • **WIDE-BASE WHEELS**—for increased tire mileage • **BALL-TYPE STEERING**—for easier handling • **UNIT-DESIGN BODIES**—for greater load protection • **ADVANCE-DESIGN STYLING**—for increased comfort and modern appearance.



NEW Easy to Clean Resists Corrosion

CORROSIVE ATMOSPHERES CAN'T HURT this Allis-Chalmers totally enclosed, fan-cooled motor because major parts are enclosed in a rigid corrosion resistant cast iron frame! No extra treatment is needed and cast iron's corrosion resistance won't chip off.

Lower Maintenance, Too

No corners, pockets or hidden air passages to collect dirt. Cleaning is the simplest of maintenance operations. Just blow off the dirt with an air hose. Fan and housing design keep cooling airflow tight against the yoke so dirt does not accumulate and cleaning is seldom required.

Factory Lubricated Bearings

Bearings are lubricated at the factory and operate without attention or cost for years. Extra rigidity of the cast iron frame holds bearings in true alignment under all operating conditions. This gives long bearing life and low operating costs.

Get All The Facts

The new *Safety Circle* totally-enclosed fan-cooled motor is built in all NEMA standard frame sizes from 224 to 505. Call your nearest Allis-Chalmers Authorized Dealer or Sales Office for complete information or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B6144. A-3228

Safety Circle, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

RUST IS COSTLY!

PREVENT IT WITH

ALONG RAILROADS

IN INDUSTRIAL ATMOSPHERES

ALONG THE SHORE

Copperweld

TRADE MARK

NON-RUSTING **STRAND**

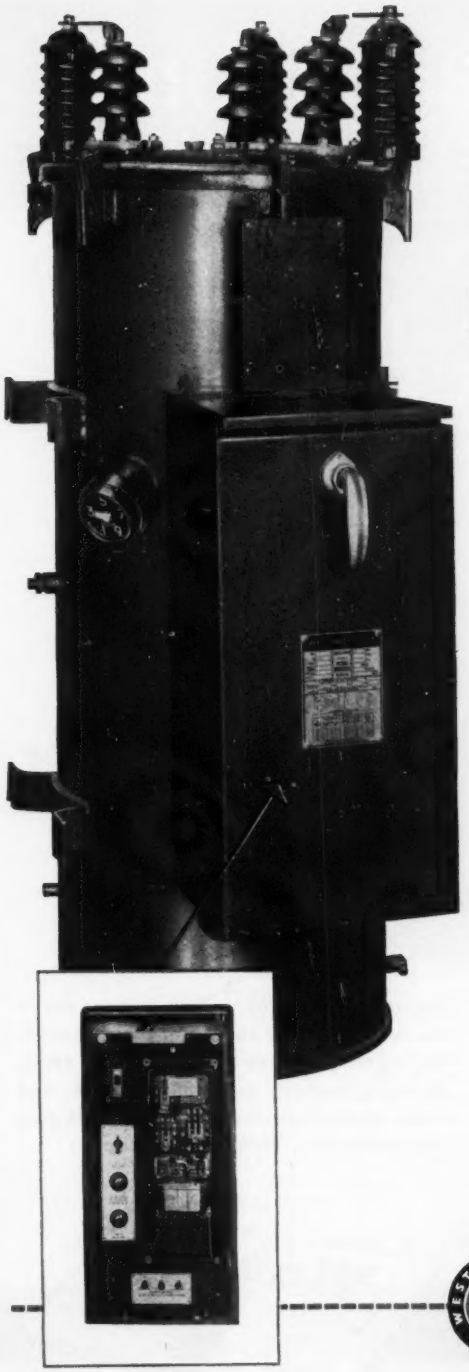
It's the thick copper covering on each of the wires that prevents Copperweld Strand from rusting—and protects each of the strong alloy steel cores *permanently*. That's why Copperweld guys and messengers retain their original strength, provide dependable, trouble-free support year after year.

And since it can't rust, Copperweld Strand will cost you less in the long run—replacements just aren't necessary.

This rugged strand is versatile in the field. It can be bent, served, moused or clamped. The natural ductility of copper and the strength of the molten-weld eliminate danger of cracking, flaking or peeling.

Engineering Data will be sent on request.

COPPERWELD STEEL COMPANY
GLASSPORT, PA.
Sales Offices in Principal Cities



MOUNT IT ON ONE POLE...

SAFELY

The URL-8 Feeder Voltage Regulator, due to its light weight, can be mounted safely on *one* pole. Improve voltage regulation in rural areas . . . with minimum installation costs. Simplified construction, including a lightweight Hipersil® core, now makes this possible . . . assures the weight reduction necessary for one-pole mounting.

Along with lower installation costs, you get these additional advantages:

Simplified Tap Changing and Control: Simple, direct tap changer drive cuts maintenance to a bare minimum. Control is automatic. Control cabinet may be mounted on the regulator or separately on the pole.

Improved Regulation . . . Voltage Control: New voltage-regulating relay provides suitable inverse time-delay before initiating tap change. Separate resistance and reactance line drop compensation is adjustable by individual dials.

Convenient Drawout-Type Flexitest Mounting: New package control is mounted in a handy, drawout-type flexitest case. Assembly can be removed as a unit to be tested or repaired, or a stand-by unit can be inserted in a matter of seconds. A manual control is provided for aid in making relay adjustment.

Get complete information on these and other advantages from your Westinghouse representative, or write for Catalog 47-430. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70585

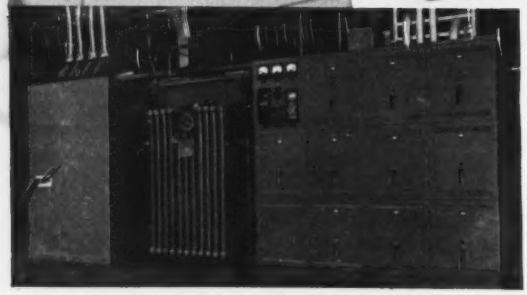
YOU CAN BE SURE... IF IT'S Westinghouse

VOLTAGE REGULATORS

Wagner®
TRANSFORMERS
. . . the choice of leaders in industry

Wagner Unit
. . . designed for

switchgear
to fit
your needs



750 kva, type HPBN, 13,800 to 480 volt, 60 cycle, 3 phase Noflamol transformer in one of 14 Wagner-equipped unit substations in a large synthetic textile plant.

Wagner Unit Substation Transformers are in use in all kinds of industrial plants including: synthetic rubber, petroleum, steel, chemical, aircraft, automotive, paper, and many others. Bulletins TU-13 and TU-56 give full information. Write for your copies.

Wagner
Electric Corporation
1891 1951

Substation Transformers

plant power distribution systems

The ever-increasing demand for electric energy to power today's stepped-up production presents a critical problem. The answer to this problem has been found in load-center power distribution systems. Unit substations, located near the load, provide a flexible source of power at utilization voltages which is delivered to the point of use by short secondary feeders.

The vital part of the load-center system is the transformer. If a switch or circuit breaker fails, only a part of the system is affected—but if the transformer fails, the entire system is dead.

Wagner Unit Substation Transformers assure a continuous, dependable flow of power. They are carefully designed to meet your distribution requirements. Oil-filled and non-inflammable liquid filled (Noflamol) transformers are available with various types of entrances and controls for the high-voltage circuits, and with proper throats on the secondary side to connect to any make of switchgear, in the usual range of ratings up to 2000 kva.

The importance of the transformers in your plant power distribution system cannot be over-emphasized. Consult a Wagner-trained field engineer to help you solve your load-center problems. No obligation, of course.

Dry Type Indoor Transformers

in ratings from 100 to 2000 kva

To meet industry's growing need for larger indoor dry-type load center transformers, Wagner now furnishes three-phase dry-type transformers in ratings up to 2000-kva in the 15-kv class and below. Especially developed for plant power distribution circuits, these units are compactly housed in neat, attractive enclosures, which can be arranged to include primary and secondary switchgear compartments to form readily accessible, closely-coupled unit substations. Complete enclosure of all equipment protects against accidental contact with live parts. Relatively light in weight, so that they can be used in multi-story buildings, they are readily adaptable to any installation requirement.

WAGNER ELECTRIC CORPORATION

6456 PLYMOUTH AVE. • ST. LOUIS 14, MO., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

T51-6

Simple Arithmetic Proves

You Can't Beat Creosote Oil* as a Preservative

***Especially U·S·S CREOSOTE OIL**

Divide the total initial cost of a tie treated with creosote oil by the years of service life you can expect. Then apply the same formula to an untreated tie, or to a tie treated with a less-permanent preservative.

Your figures will prove that the annual charge for creosoted ties is much *less* . . . the many extra years of service far offset the cost of creosote oil treatment. Translate these figures into practice and you'll trim your annual tie replacement costs sharply for years to come.

But, for best results and lowest costs, be sure that U·S·S Creosote Oil is used. Its uniform quality, the result of *continuous* processing, makes it possible for you to obtain the same high performance, application after application.

If you are interested in more information, please write to the nearest sales office listed below. There is no obligation.

UNITED STATES STEEL COMPANY
525 WILLIAM PENN PLACE · PITTSBURGH 30, PA.
71 Broadway, New York 6, N. Y.
208 South La Salle St., Chicago 90, Ill. 1509 Terminal Tower, Cleveland 13, Ohio
Brown-Marx Building, Birmingham 2, Ala. 25 Beale St., San Francisco 5, Calif.

USS

CREOSOTE OIL

UNITED STATES STEEL

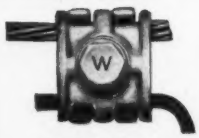
MAKE A

Good Connection

WITH **WEAVER**

1-WS
Copper to Copper
(Also available for general purpose use —1-WS-C)

WSB-C
Cadmium Plated General Purpose
(Also available for copper to copper connections—WSB)



K-1 Jumper Clamp
(Also available for aluminum, steel, or copper to similar conductor.)

A-111 Armor Rod Jumper Clamp
(Also available for aluminum to aluminum connections.)

HIGH STRENGTH CONSTRUCTION THROUGHOUT — WEAVER HOT LINE CLAMPS are cast of high strength ELECTRO-BRONZE. This exceptionally strong metal is specially alloyed in our own electric furnaces so that each operation from melting to final assembly is quality controlled.

MAKE BETTER CONNECTIONS — With WEAVER HOT LINE CLAMPS you are assured of high pressure connections, since ELECTRO-BRONZE produces low friction, free running threads which efficiently convert more of the tightening torque to pressure on the conductor — without distortion — and there is no freezing of the tightening bolt with ELECTRO-BRONZE.

COVER LARGE WIRE RANGE — The popular catalog #1WS, for instance, accommodates number 6 to 4/0 stranded main and number 6 to 2/0 tap — this feature cuts inventory.

DESIGNED TO STAY TIGHT — Both main line and tap wire connections are secured with SHAKEPROOF lockwashers to provide permanent, trouble-free connections that won't loosen under vibration.

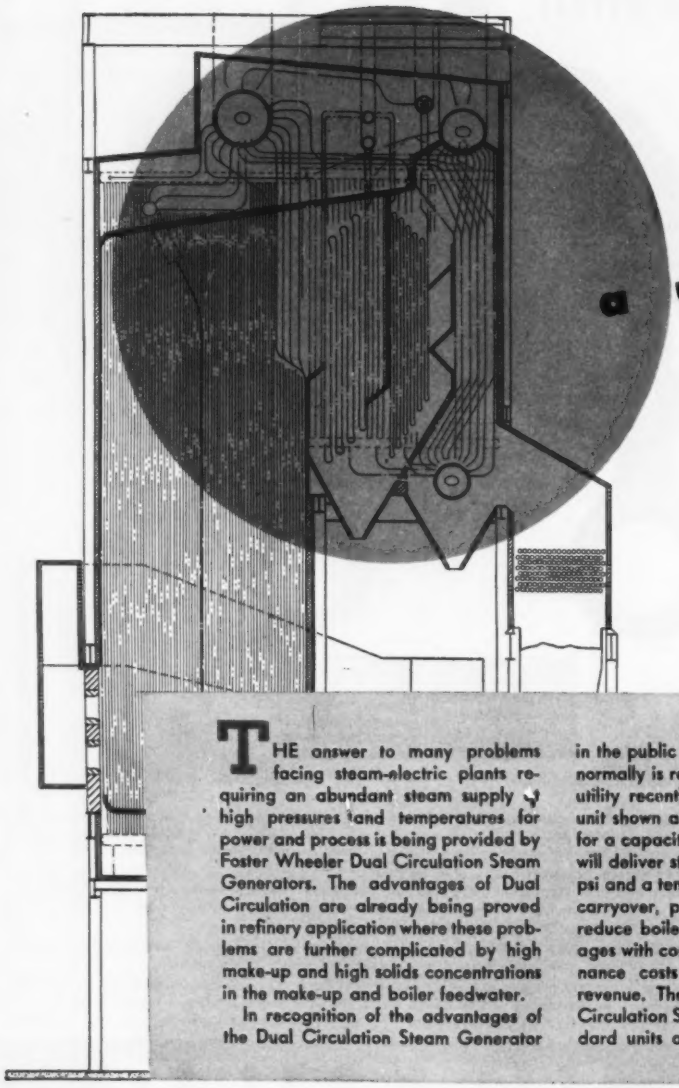
FOR TOP QUALITY AT LOWEST COST . . . YOU CAN'T BEAT WEAVER HOT LINE CLAMPS!

Write for the latest Weaver Catalogue

JAW

J.A. **WEAVER** CO.

2110 HOWARD ST · ST.LOUIS, MO · CE. 0881



a utility

THE answer to many problems facing steam-electric plants requiring an abundant steam supply at high pressures and temperatures for power and process is being provided by Foster Wheeler Dual Circulation Steam Generators. The advantages of Dual Circulation are already being proved in refinery application where these problems are further complicated by high make-up and high solids concentrations in the make-up and boiler feedwater.

In recognition of the advantages of the Dual Circulation Steam Generator in the public utility field where make-up normally is relatively low, a midwestern utility recently ordered the three-drum unit shown above. This unit is designed for a capacity of 425,000 lb per hr and will deliver steam at a pressure of 1350 psi and a temperature of 955 F. The low carryover, previously unattainable, will reduce boiler and turbo-generator outages with consequent savings in maintenance costs and gains in operating revenue. The advantages of the Dual Circulation Steam Generator over standard units are illustrated at the right.

● *Write for a Copy of Bulletin B-50-11*

FOSTER WHEELER CORPORATION 165 BROADWAY NEW YORK 6,

specifies... DUAL-CIRCULATION

REDUCED CARRYOVER OF

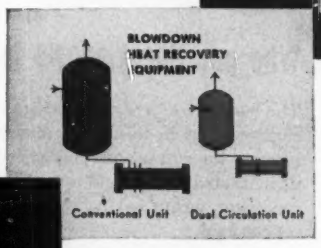
a. Silica

b. Total Dissolved Solids

LOW CONCENTRATION IN HIGH DUTY FURNACE SECTION RESULTING IN

a. Minimum Tube Damage

b. Reduced Maintenance and Outage Time



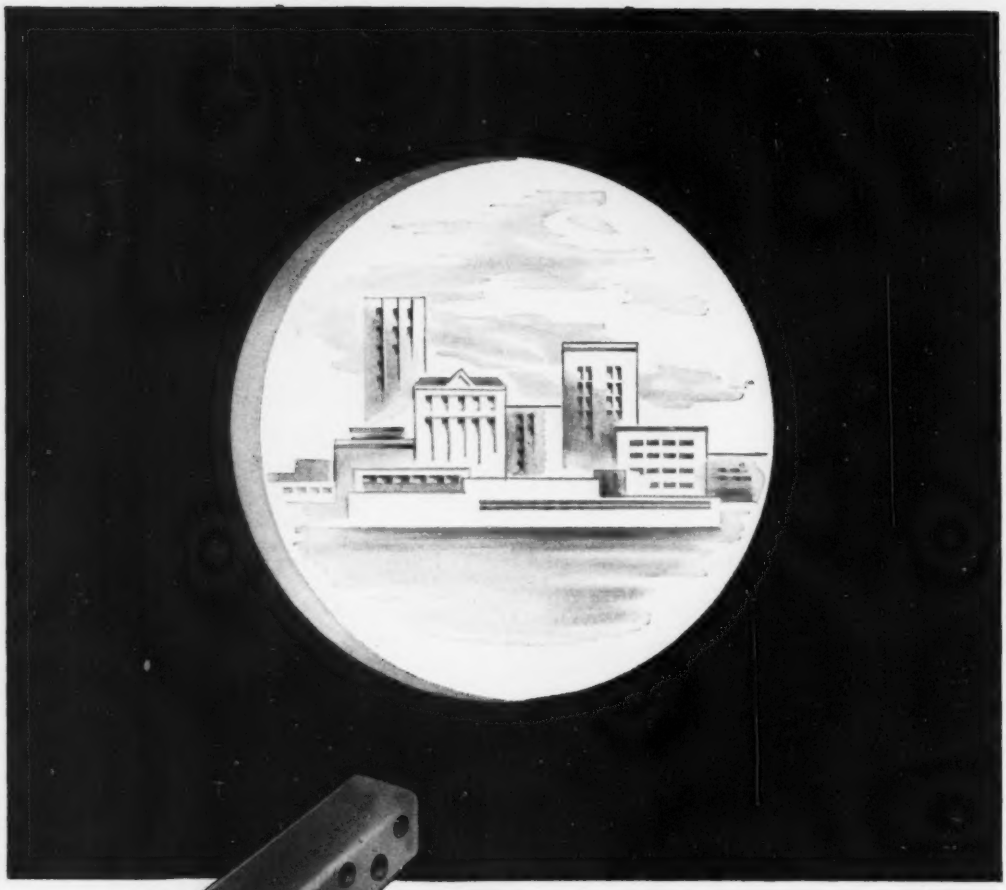
IMPORTANT SUPPLEMENTARY ADVANTAGES IN CERTAIN APPLICATIONS

a. Reduced Blowdown With Resulting Reduction In Heat Loss and Size of Heat Recovery Equipment

b. Reduced Cost of Chemicals and Equipment For Water Treatment

NEW YORK

FOSTER WHEELER



Who put the windows in Bus Conductors?

The **"windows"** are ventilating holes which Chase engineers put in to aid the dissipation of heat. They increase the current carrying capacity about 20% over unventilated tubes. And a ventilated square tube bus conductor means saving up to 36% in the weight of copper used.

When you add to this high mechanical strength, ease of assembly and erection and resistance to corrosion, you'll agree that Chase square copper tube conductors are ideal. Write Dept. EW 451 for the Chase Bus Conductor Handbook.

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• The Nation's Headquarters for Brass & Copper

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
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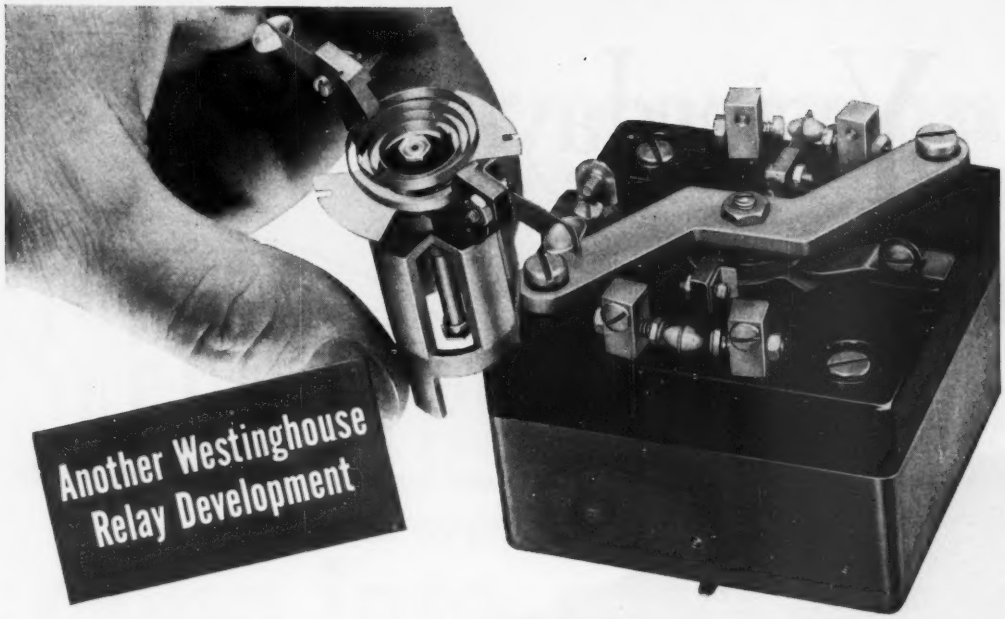
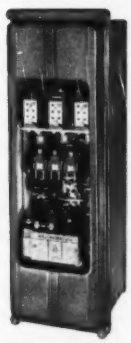
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(Trades office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	



New double-loop directional element ELIMINATES VIBRATION...



The Type HZM, and Type HZ, high-speed impedance relays are now available with the new double-loop directional element.

Westinghouse High-Speed Impedance Relays now offer you extra operating benefits. A new directional element, featuring double-loop design, eliminates troublesome 120-cycle vibration.

The torque produced in each loop is a double frequency sine wave. However, as these waves are 180 degrees out of phase and offset in the same direction, the net torque in both loops is a constant value—eliminating vibration. The result is an efficient, high-speed directional element, providing low burden, good sensitivity in a sturdy rugged enclosure . . . a sharper intelligence for vital relaying applications.

For complete information write for Silent Sentinel Bulletin No. B-4794. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40402

YOU CAN BE SURE... IF IT'S
Westinghouse
RELAYS

Yesterday, corroded and costly!

So . . .

Corrosion is common wherever iron and steel are exposed to the elements. But not so many years ago, it was a particularly costly problem to the electrical industry. In those days electrical wiring systems often required additional wires to carry the constantly increasing power load. Ordinarily, the new wires would be fished through the conduit. But frequently the conduit was rusted through, making fishing impossible and necessitating a new conduit installation. This was troublesome, time-consuming and above all, expensive—especially when it involved ripping out building walls to replace the corroded conduit buried therein. Obviously, someone had to put *permanence* in wiring.

PIONEERING IS SIMPLY DOING THE OBVIOUS FIRST

conduit was common

SHERARDUCT

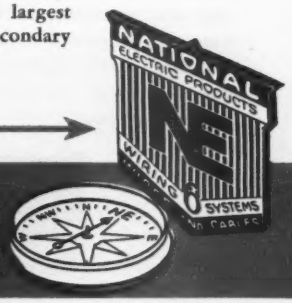
RIGID STEEL CONDUIT

came into existence

National Electric Products Corporation realized there were many ways to fight corrosion—by painting, by introducing alloying elements into steel, by galvanizing. There was also *sherardizing,* a dry galvanizing process of alloying zinc dust to metal under heat, thereby providing a permanent protection against rust. Although the process was tricky and difficult, NE sherardized its rigid steel conduit—called it Sherarduct—and solved the costly problem of corroded conduit!

For more than 40 years, Sherarduct has meant *permanence in wiring*—the *quality* conduit that "will last as long as the building stands." And for as many years National Electric has stood for "everything in wiring"—the world's largest producer of *the complete line* of secondary electrical distribution systems.

EVERYTHING IN WIRING POINTS TO



National Electric
PRODUCTS CORPORATION
1305 CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.

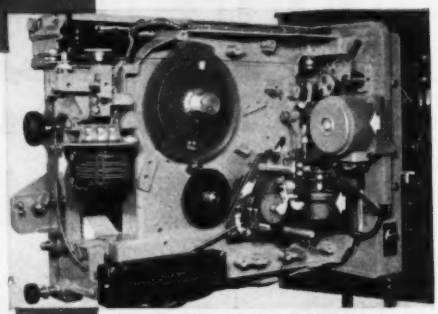
CHECK THE FEATURES OF THE ELECTRONIK POTENTIOMETER THAT MEAN MOST TO YOU . . .

SIMPLICITY
ACCURACY
DEPENDABILITY
RUGGEDNESS
FLEXIBILITY

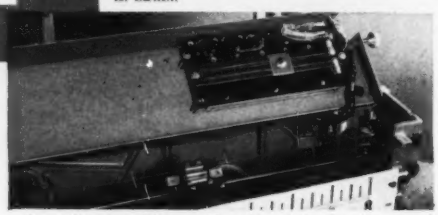
UTILIZE THE ACCURACY OF *ElectroniK* POTENTIOMETERS

Check these ACCURACY features:

- √ *Sturdy electronic amplifier replaces delicate galvanometer.*
- √ *Unaffected by vibration.*
- √ *Interchangeability of standardized parts without loss of accuracy.*
- √ *Movement of balancing motor occurs only when measured variable changes.*
- √ *Entire instrument enclosed in a dust and moisture resistant case.*
- √ *Totally enclosed slide wire.*



Rear view of chassis shows the Slidewire (cover removed) Standardization Unit, Chart Drive and Selector Switch.



Span adjustment slide mounted on rear of circuit resistors panel.

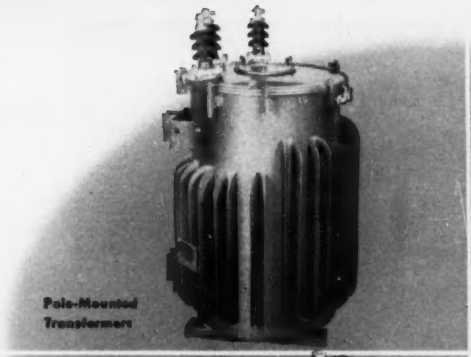
THE *ElectroniK* Potentiometer's inherent accuracy and ruggedness make it an ideal recorder for central stations. All of the power plant variables . . . pressure, temperature, flow, electrical power, frequency, speed . . . can be accurately measured and recorded by this electronic Continuous Balance instrument.

Laboratory accuracy with industrial stamina . . . is insured through the use of the Continuous Balance principle, simplified design and precision made parts. These features . . . coupled with dependable performance and flexibility of application . . . make the *ElectroniK* Potentiometer a must for your power plant.

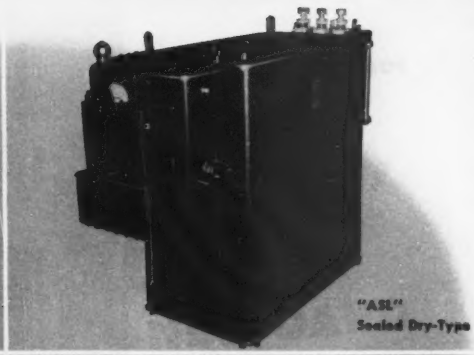
Call in your local Honeywell engineer for a discussion of instrumentation in your plant . . . or write for a copy of Bulletin 90-1.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

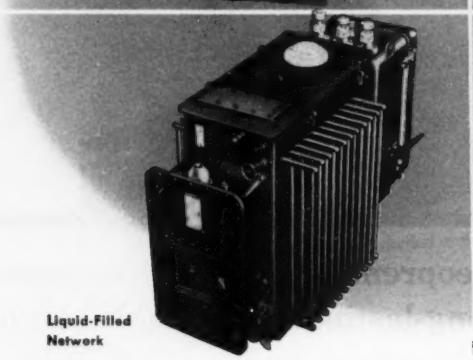
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS



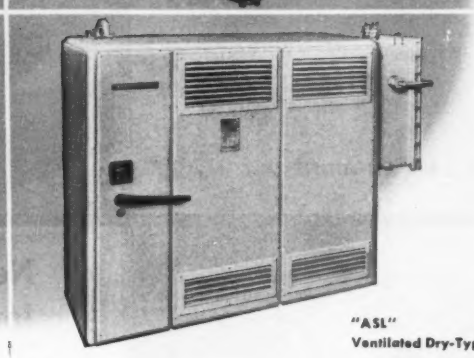
Pole-Mounted Transformers



"ASL" Sealed Dry-Type



Liquid-Filled Network



"ASL" Ventilated Dry-Type

Standardized Transformers make networks pay... *FASTER!*

Sure, network systems pay. The big savings come from continuity of service, flexibility to meet changing demand. But there's another important saving available right now. That's the saving you can realize in transformer costs. Standardization brings production economies that are passed directly to you.

These four standard transformers meet every network requirement:

FOR GENERAL USE. Liquid-Filled Transformers, the workhorse of the network system. Available in sizes 1000 kva and below, 34,500 volts and below, oil or Inerteen® filled.

FOR INDOOR SERVICE. Dry-Type Transformers, ideal for indoor networks . . . lightweight, economical and maintenance-free. Available in sizes 1000 kva and below, 15,000 volts and below.

FOR GREATEST SAFETY. Sealed Dry-Type Transformers give greater safety for crowded areas, or where hazards like explosive gas atmospheres, corrosion or water conditions are not suitable for ventilated dry-type. 1000 kva and below, 15,000 volts and below.

TOPS FOR ECONOMY. Pole-Mounted Transformers for overhead networks. Available in a wide range of sizes, from 150 kva and smaller 15,000 volts and below.

Let us talk them over with you and point out the specific economies that can fit into your plans best. In addition, our complete facilities . . . engineers and calculating boards . . . are available to help you make future expansion more economical. Ask your Westinghouse representative, or write for booklets B-4028 and B-4002A. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-70587

YOU CAN BE SURE.. IF IT'S

Westinghouse

NETWORK TRANSFORMERS

FOR A PLAYING FIELD...

...OR AN AIRFIELD

Neoprene-jacketed cable assures long-lasting, dependable service

For athletic field or airport lighting . . . installed overhead or underground . . . neoprene-jacketed cable is *right* for the job. Installations that have been up for over eleven years prove continuous exposure to glaring sun has little effect on neoprene. Soil acids won't cause it to rot underground. Galvanic action, destroyer of metal sheaths, won't harm neoprene. Even on oil and gasoline soaked runways, neoprene won't become soft and sticky. It provides lasting protection for the insulation under toughest conditions.

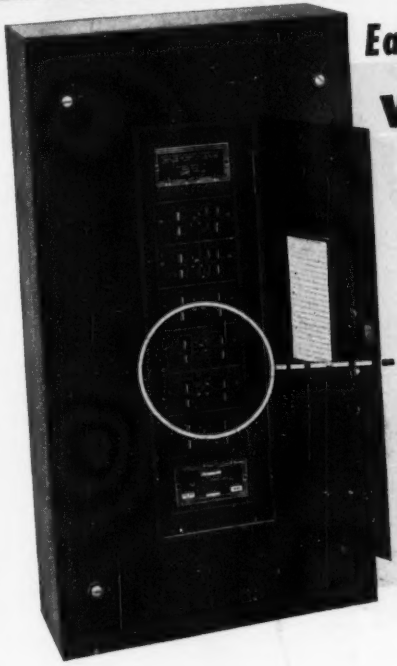
So ask your supplier about neoprene-jacketed cable. Leading manufacturers make it in single or multiple conductor types, in voltage rating to fit your requirements. You'll find this cable costs less to maintain and requires fewer replacements . . . whether the service is rural, urban or industrial. For some ideas about new neoprene applications that may help you, send for "The Neoprene Notebook." No charge, of course. Write: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division G-4, Wilmington 98, Delaware.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

Tune in Du Pont "Cavalcade of America"—Tuesday evenings, NBC—coast to coast



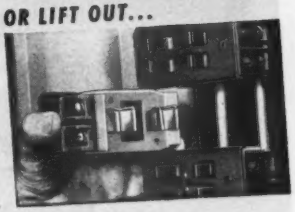
Easy to Add or Change Circuits

WITH THIS NMO "PLUG-IN" PANELBOARD

a "Natural" wherever a large number of branch circuits for lights, appliances and business machines must be switched and protected

1 SWING OUT...

2 OR LIFT OUT...



3 ATTACH WIRES...

4 "PLUG-IN"

Flexibility **Four-circuit Multi-breaker units have "Plug-in" feature. Any combination of 15, 20, 30, 40, or 50 ampere circuits available. Dummy units can be inserted to anticipate future requirements. *Easy to Wire*—Multi-breaker units can be swung or lifted out to attach wires. Approved connector eliminates "looping." *Smaller Size*—Compact Multi-breaker unit permits more circuits and larger wiring gutters without increase in overall panel size. Better utilization of wall and column space.**

THERMAL-*Coilless*-MAGNETIC BREAKER UNITS GIVE 2-WAY PROTECTION

Thermal Element **responds to heating effects of both load current and surrounding atmosphere. Total temperature is limited to a safe value.**

Magnetic Element **responds instantly to heavy overloads or shorts.**

BOTH Elements are needed for COMPLETE Protection!

Illustrated NMO Bulletin SA567R gives complete information on the new Panelboards. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

EXPERIENCE + { MODERN FACILITIES / MODERN METHODS / MODERN THINKING

MEANS "It MUST Be Right!"

Triangle's two plants—one making wire and cable in New Brunswick, New Jersey, the other making conduit in Moundsville, West Virginia, have kept pace through the years with every advancement and are completely modern in machinery and equipment.

When it comes to wire, cable or conduit, you want assurance that it's *right* — right in quality, right in performance. Triangle products are right! Triangle's *long experience* coupled with modern machinery, modern methods and modern thinking means "It *Must* Be Right!"

Triangle products are built to the highest possible specifications under the supervision of craftsmen who take pride in surpassing accepted standards.

Experience plus modern facilities, modern methods, modern thinking — that's why Triangle can say with confidence — "IT *MUST* BE RIGHT!" That's why you can specify Triangle and know that "IT *IS* RIGHT!"

THIS MAN WANTS TO HELP YOU!

He is your Triangle Distributor. In the same way Triangle offers quality *products*, your Triangle Distributor offers unexcelled *service*. See your Triangle Distributor *first*. In the long run you'll save and get it faster, from a Triangle Distributor.

THE TRADE-MARK OF TOP QUALITY!

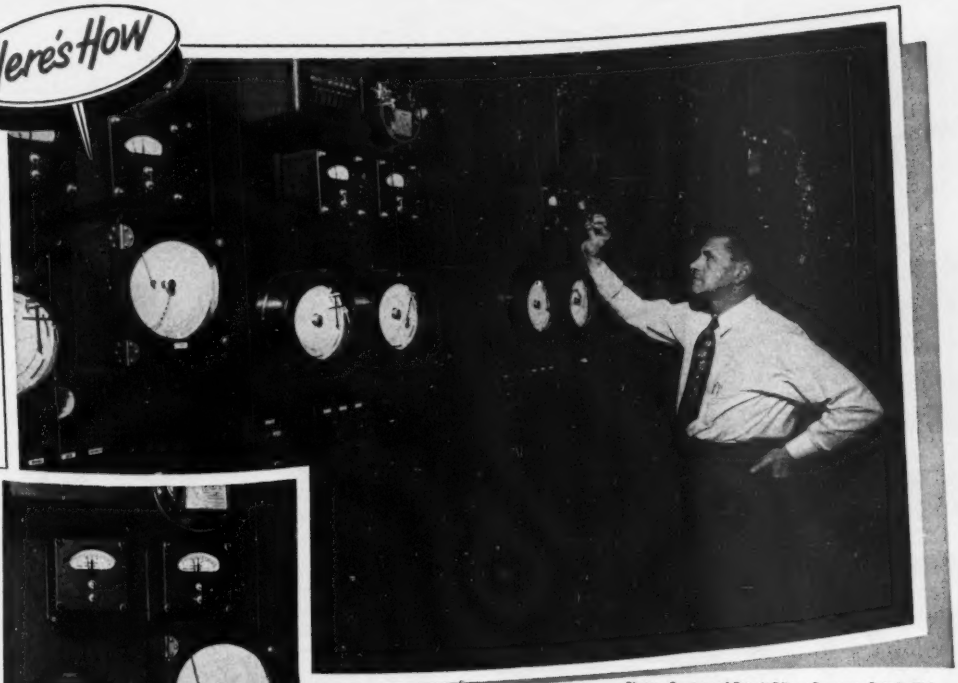
TRIANGLE CONDUIT & CABLE CO., INC.

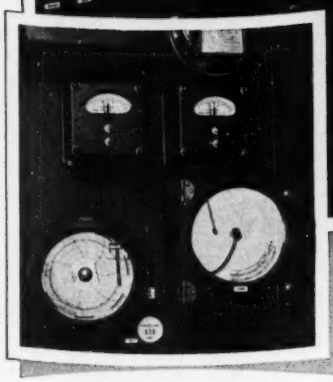
NEW BRUNSWICK, NEW JERSEY

IT *MUST* BE RIGHT

"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Armored Cable • Service Entrance, Service Drop, Varnished Cambric Braided or Leaded, Trioprene Trench, Power and Parkway Cables • Bare Wire • Rigid Conduit Hot-Dipped Galvanized • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit

Here's How

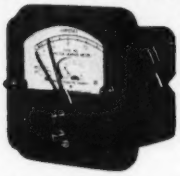




Photos: Courtesy of Detroit Edison Company, Detroit, Mich.

You can get the maximum out of your existing Distribution Equipment

LINCOLN TYPE AD-2
Ampere Demand Meters



LINCOLN TYPE CCA
Graphic Demand Meters

To load your distribution system to the ultimate safe limit, you *must* know the load on your feeders. Lincoln Ampere Demand Meters give you the facts you need—on the basis of *continuous* information—to keep the loads between feeders balanced.

Type AD-2 Thermal Ampere Demand Meters show the demand on the feeder phases at all times as well as the maximum demand reached since the last manual resetting.

Type CCA Graphic Ampere Demand Meters provide an accurate and reliable means of ascertaining this information wherever a record of the time and duration, as well as the magnitude, of the demand is required.

Bulletins 450, 461 and 467 tell the whole story—write for your copies.

Sangamo J Meters

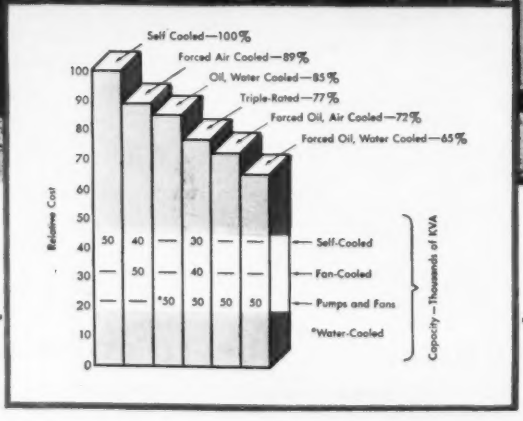
These watthour meters meet today's requirements and tomorrow's anticipated loads with sustained accuracy, economy of maintenance and troublefree performance.

SM51-4

Only Measured Facts are Known Facts

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



Cost and performance comparison of 50,000 kva, 115 kv, three-phase transformers for different methods of cooling.

ADVANCED COOLING TECHNIQUE

Cut Capital Investment 15% to 35%

Three-phase power transformers provide substantial savings over single-phase banks. That's well recognized. In many instances, the savings run as high as 28%.

But modern cooling, applied to three-phase transformers can bring even greater savings.

Consider the cost of a three-phase, self-cooled transformer as a 100% base. Then a modern external water cooler (OW) permits a reduction of 15%. The use of forced-oil, forced-air cooling (FOA) can bring a cut of 28%. And, for some applications, a combination of forced-oil cooling *and* external water cooling (FOW) can effect a total savings of 35%.

Thus, through application of advanced cooling techniques alone, substantial cuts can be made in the cost of three-phase transformers... savings that can be brought to 50% and more, as compared to the cost of single-phase transformer banks.

WESTINGHOUSE POWER TRANSFORMERS are smaller and lighter per kva than any other transformer on the market. As a result, you can expect these additional savings:

1. **Reduced space required.**
2. **Smaller foundations.**
3. **Smaller superstructures.**
4. **Lower field-assembly expense... transformers shipped more completely assembled.**
5. **Lower maintenance expense... rugged, all-welded construction plus smaller size.**

Yet all this is merely a portion of the savings possible with Westinghouse Transformers. Our representatives will be glad to discuss additional features that mean big savings to you. Phone today, or write: Westinghouse Electric Corporation, P. O. Box No. 868, Pittsburgh 30, Penna.

J-70579

WESTINGHOUSE POWER TRANSFORMERS ARE SMALLER AND LIGHTER PER KVA THAN ANY OTHER TRANSFORMER YET THEY GIVE SUPERIOR PERFORMANCE

YOU CAN BE SURE... IF IT'S

Westinghouse

POWER TRANSFORMERS

ADD UP THE SCORE ON DE LAVAL'S *Double Protection*

2 + 2 = 4

1. REMOVAL OF BOTH DIRT AND WATER

De Laval machines remove both of the impurities that contaminate turbine lubricating oil. Centrifugal force throws all dirt out of the oil and stores it out of harm's way in the bowl; it separates out any water present and continually discharges it. Water once removed cannot recontaminate the oil.

2. CENTRIFUGAL FORCE DOES NOT REMOVE ADDITIVES

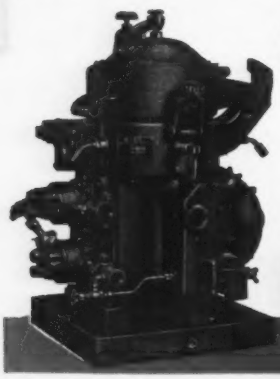
Centrifugal force alone never removes additives. Naturally inhibitors that are soluble in water will be lost with water that is removed from the lubricating oil, whether such removal is effected by centrifugals or filters. Usually very little water is present to be removed, so this cause of inhibitor reduction is inconsequential, but should a major water leak occur in the lubricating system, the centrifuge will promptly remove the water.

3. QUICKER . . . MORE COMPLETE SEPARATION

De Laval machines multiply the effectiveness of gravity over thousands of times! This means that quicker and more complete separation is possible by centrifugal force than by gravity methods. Moreover, De Laval machines are constant in efficiency. There are no functional parts to lose effectiveness during a run.

4. CENTRIFUGES TAKE CARE OF EMERGENCIES

De Laval machines are conservatively rated. They can handle wide variations in water without loss of seal or carry-over into the oil stream.



Most Protection per dollar—De Laval's Double Protection for turbines is complete and economical.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL OIL PURIFIERS

for more dependable power production

"...every management man should know how to MAKE STANDING POLES LAST LONGER"

From an actual photograph supplied by Public Service Company of Colorado

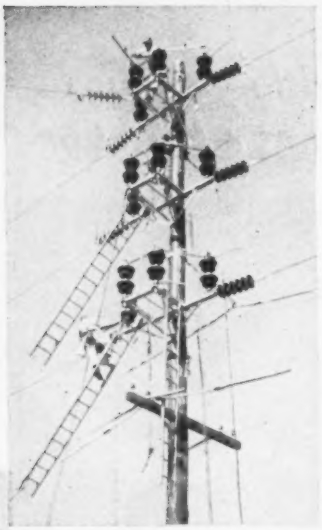
OSMOPLASTIC *penetrates deeper to protect longer*

Here's graphic proof that the Osmoplastic groundline treatment is the practical and proven way to add *many years* of extra service life to your older standing poles. The above illustration is an actual photo of a test disc cut from 8" below the groundline on a Western Red Cedar pole by the Public Service Company of Colorado. This pole had originally been incised and treated with creosote. Six years ago it was inspected and Osmoplastic applied. The pole was removed from service for reasons other than decay in 1950 and discs were cut from the groundline area. The outer black band is the original creosote. Now look at the great yellow area! That's how far Osmoplastic penetrated right through the original creosote!

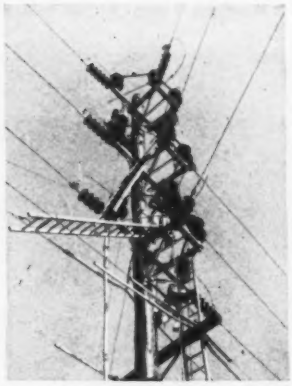
This complete yellow section was created by subjecting the disc to the zirconium alizarine reagent test which determines the presence of sodium fluoride in toxic amount. Osmoplastic is protecting this whole yellow area against decay and the only area not reached by Osmoplastic's super-penetration is the gray portion in the very center. Let us tell you more about our combined groundline inspection and treating service for older standing poles.

OSMOSE WOOD PRESERVING CO. OF AMERICA, INC.
1437 BAILEY AVENUE BUFFALO 12, NEW YORK

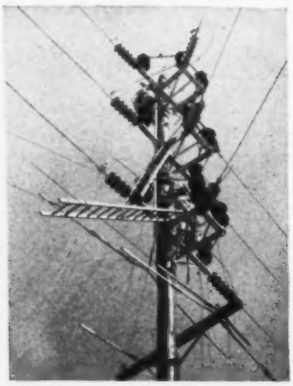
FASTER...MORE ECONOMICAL INSTALLATION with MATTHEWS GOABS!



1. Connecting top and bottom phases of tap.



2. Hoisting left operating pipe. Underbuild is 4160 volts and telephone circuit.

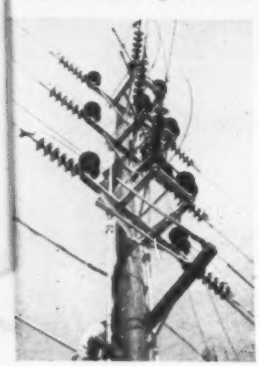


3. Attaching left operating pipe to top phase.

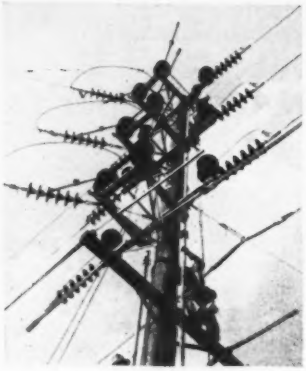
These photos show the progressive steps and complete installation of a Catalog 69KV600 MATTHEWS GOABS—installed February 18, 1951 by the Georgia Power and Light Company on the tap pole serving the Colquitt County R. E. C. at Troupeville, near Valdosta, Georgia. A crew, consisting of three linemen, a foreman and truck driver, began work at 8:30 a. m. The installation was completed by 4:30 p. m. The under-build of 4,160 volts and telephone circuit were worked hot during installation.

The company purchased its first Catalog 69KV600 MATTHEWS GOABS in June 1949. Since then, it has purchased three additional units of the same rating—as further indication of complete satisfaction.

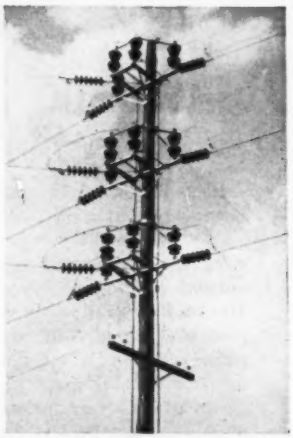
MATTHEWS GOABS not only save in erection costs (approximately $1,000.00 on a 69KV rating), but reduce the need for such critical materials as steel, copper, insulators and wood poles.



4. Both operating pipes in place. Installing guide for left operating pipe. Left switch blades open.



5. Testing and adjusting both switch blades open.



6. Completed installation.

Write for Bulletin 601

W. N. MATTHEWS CORPORATION

3844 DELOR STREET, ST. LOUIS, MO.

ENGINEERS and MANUFACTURERS SINCE 1899

Fly Ash Precipitators

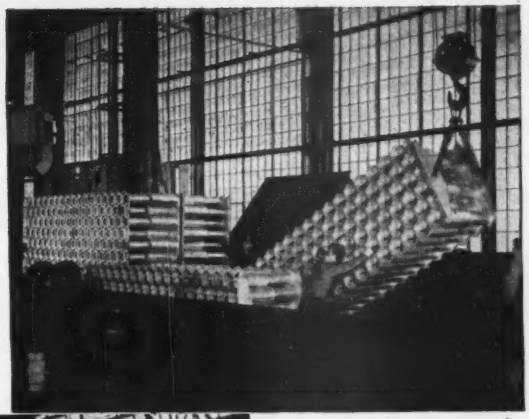
for

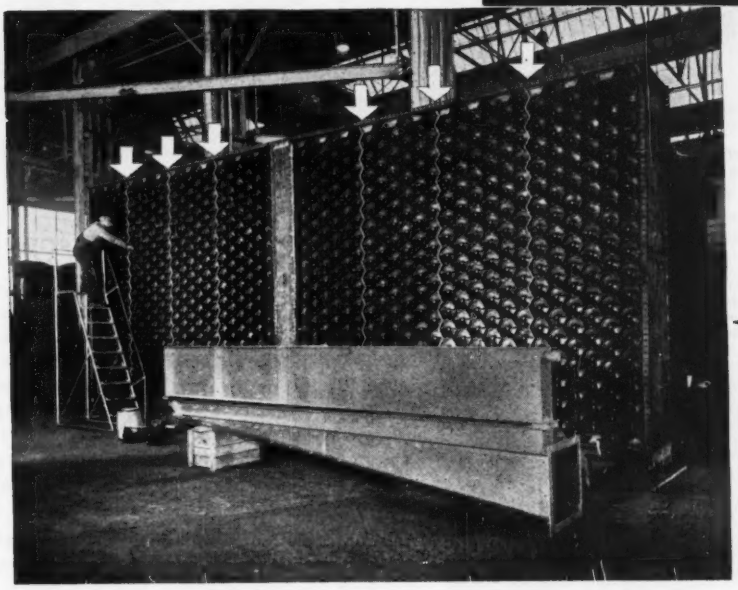
Consumers Power Company

Justin R. Whiting Plant at Erie, Mich.

Engineers: Commonwealth Associates, Inc.

Ever-increasing demand for electric power has prompted still another of America's great public utilities, Michigan's Consumers Power Company, to expand and enlarge its facilities and services.





↑ **1. Here are** sections of a Type ST Fly Ash Precipitator, ordered by Consumers Power Company, being loaded into a railroad car. Because the units are furnished partially assembled, they are easier to handle and field erection is simplified. This precipitator will be used on a 600,000# steam/hr. pulverized fuel fired boiler for a flue gas volume of 350,000 cfm. A duplicate of this precipitator for a second boiler is in production now.

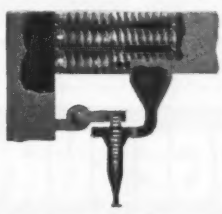
←**2. Assembled** unit receives final inspection prior to shipment. There are 816 tube elements forming 2 banks and arrows indicate lines of mating sections which are match-marked to simplify assembly. Other American Blower equipment on this order for Consumers Power includes: 2 Forced Draft Fans and 2 Induced Draft Fans each equipped with Type PE Gyrol Fluid Drives together with 4 Gyrol Fluid Drives for Boiler Feed Pumps.

The simple principle of operation of the type ST Fly Ash Precipitator combines refinement, proportions and methods of construction which result in a more efficient, compact and economical unit.

If you have a fly ash problem and would like further information on American Blower Fly Ash Precipitators, write to our nearest Branch Office and literature will be sent to you without obligation.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



Principle of Operation

Fly ash laden gases entering main tube are forced to outside by spinner element. This action sets up centrifugal force which concentrates fly ash near tube wall. Cleaned gases in center of tube pass on through outlet tube.

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

"It has won my confidence over the years

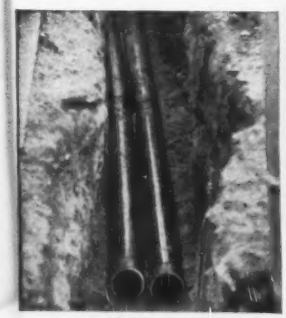
That's why I Specify

ORANGEBURG"

— says the Utility Engineer

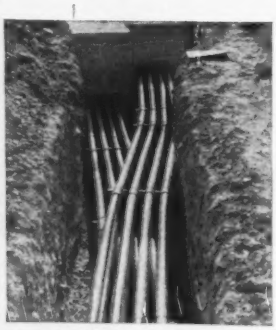
Here are some of the reasons why this Utility Engineer, and many others like him, entrust their vital cables to Orangeburg for permanent protection.

• Will not corrode. Lasts indefinitely. • Impermeable wall and tight joints prevent corrosive ground waters from entering. • Lays faster and at lower cost than any other type of conduit. • Low coefficient of friction keeps pulling tensions on cable to minimum. • Protects cable sheath from abrasion when pulled in—also from wear during cable movement due to alternate expansion and contraction with changing loads. • Resists acids, alkalis, grease, oil. • Light, easy to handle and tool on the job. • Tough, resilient—will not crack or break when properly handled.



ORANGEBURG NOCRETE

Installed *without* concrete encasement. Its extra heavy wall makes NOCRETE practical for many single or double duct runs.



ORANGEBURG STANDARD

Installed with concrete encasement. The *preferred* conduit for banks of three or more ducts.

OUR NATION MUST HAVE UNINTERRUPTED POWER

One of today's great national assets is the continuous flow of power to industry, business and home. Every utility engineer knows that the unfailing supply of power depends on well protected cables. Cables always get that protection from Orangeburg Conduit. For 58 years, Orangeburg has successfully served the Electrical Industry because of its proved ability to provide a time-defying raceway for the permanent protection of electrical services underground.

And now as the Nation looks to the public utilities and municipalities to maintain and even increase their high standards of service, more and more of them are turning to Orangeburg Conduit. They are doing this because experience has made them sure that cables installed underground in Orangeburg *stay safe* and *keep the power flowing.*

ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, N. Y.

ORANGEBURG FIBRE CONDUIT

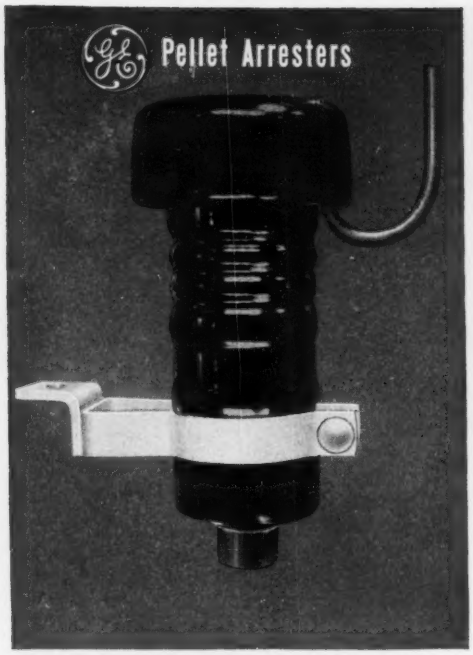
STANDARD Installed with Concrete

NOCRETE Installed without Concrete

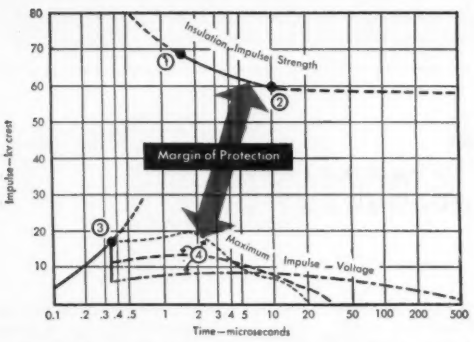
GENERAL ELECTRIC SUPPLY CORPORATION

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

GraybaR ELECTRIC COMPANY



THE G-E PELLET ARRESTER is also unequalled in durability—the only distribution arrester with series gaps sealed in dry, inert nitrogen. Gap electrodes stay bright as new. The Pellets, themselves, are unaffected by service moisture.



THIS GRAPH was made from actual volt-time and ampere-time oscillograms, and from AIEE standard test data. The demonstrated impulse strength of 2400-volt distribution transformer insulation is represented by the curve passing through: (1) the minimum impulse strength on an AIEE standard chopped wave test, and (2) the minimum impulse strength on an AIEE standard full wave test. The impulse voltage allowed by a 3-kv General Electric Pellet Arrester is determined by (3) the impulse sparkover voltage of the arrester on the AIEE standard test wave, and (4) the IR drop across the arrester to ground with (top line) a 65,000 ampere discharge—(middle line) a 20,000 ampere discharge—and (bottom line) a 1500 ampere long duration discharge. The arrows show the unequalled margin of safety.

No other distribution arrester protects so well

HERE'S THE EVIDENCE. The graph below, from actual volt-time and ampere-time oscillograms, shows the unequalled margin of safety that a 3-kv General Electric Pellet Arrester gives a 2400-volt distribution transformer. Higher rated arresters, protecting higher-voltage transformers, similarly show this unequalled margin of protection.

HERE'S THE REASON. This extra protection results from a combination of low sparkover voltage *and* exceptionally low IR drop. Whether lightning currents are high or low, with durations long or short, *no other distribution arrester holds voltages to such low levels.*

HERE'S YOUR CUE. The Pellet is a valve-type arrester for universal use on urban, rural, or industrial systems. It is available in ratings of 1 kv to 15 kv inclusive. This arrester has been *the* quality-standard for over 25 years—it's your cue for maximum protection. For further information contact your G-E representative or your authorized G-E agent.

Apparatus Department,
General Electric Company,
Schenectady 5, N. Y.

GENERAL ELECTRIC

405-36

"Mr. Bell, I heard every word you said – distinctly!" Thus, on March 10, 1876, Alexander Graham Bell (left) learned that his invention had transmitted the first intelligible speech.

75 Years of Tomorrows

Like today's telephone, Alexander Graham Bell's invention was a product of research. For several years Bell had been investigating speech and hearing, and devising methods and apparatus for the electrical communication of intelligence. No one had transmitted speech sounds electrically but Bell saw that it must be possible—given the proper instruments.

One day, while experimenting with his harmonic telegraph, Bell's alert ear caught an unexpected sound in the receiver. His trained mind told him that here at last was the proof that sound waves could travel as their facsimile in electric waves. Then followed a year of development, and in 1876, as shown above, he transmitted the first intelligible speech by telephone.

During the next three-quarters of a century, the telephone research which Bell started has grown and expanded to serve your telephone system . . . often fruitfully overflowing into other fields of electrical communication. In today's Bell Telephone Laboratories, promising ideas find the right skills to bring them to life. Through skilled manufacturing by Western Electric Company and skilled operation by the telephone company they are brought to the service of the telephone user.

The high quality of your telephone today, its fine, swift service at reasonable cost, are the products of work in the telephone laboratories in the past. The greater value you may expect in the future is taking form there already.

BELL TELEPHONE LABORATORIES

Exploring and Inventing, Devising and Perfecting, for Continued Improvements and Economies in Telephone Service

NEW M.P.L. STRAIN CLAMPS

The new Minimum Power Loss Series of Strain Clamps, now being offered by BTC, reduce hysteresis and eddy current effects to a minimum . . . save power . . . insure against heating, annealing and weakening of conductor within the clamp . . . and improve corrosion resistance.

- *5200 Series M.P.L. Clamps* Drop forged, heat-treated Aluminum Alloy Clamps, designed for A.C.S.R. and Aluminum Conductors.
- *5300 Series M.P.L. Clamps* Drop forged Aluminum-Silicon-Bronze Clamps, made from high strength, corrosion-resisting, zinc-free alloy. For Copper, Copperweld and Copper-Type Composite Conductors.

Sold through your insulator manufacturer only.

An entirely satisfactory method of dead-ending conductors on strain and angle construction is offered in *the complete line* of Transmission Hardware. For all conductors in general use . . . for all classes of construction . . . for all voltages . . . for all line current loads . . . for all conditions of atmospheric corrosion.

General design combines the superior mechanical properties and light weight of forged metal parts with a considerable reduction of the factors causing conductor-vibration damage. Slip strengths are more than adequate.

Installation is easy and economical, without special equipment . . . conductor may be strung between clamps or from clamp to apparatus without cutting and without splices, insuring permanently trouble-free operation.

Range of sizes is sufficiently wide to allow selection of just the right clamp for your conductor.

- *5000 Series Drop Forged Steel Clamps* Hot-dip galvanized and suitable for all conductors.
- *Drop Forged Stainless Steel Clamps* 5000 Series can be furnished in Non-Magnetic Stainless Steel, combining corrosion-resistance with minimum power loss and cool operation.

Write today for your copy of BTC's new Hi-Line Hardware Catalog which tells the complete story.

THE BREWER-TITCHENER CORPORATION, Cortland, N.Y.

Now...get better results from poor fuels!

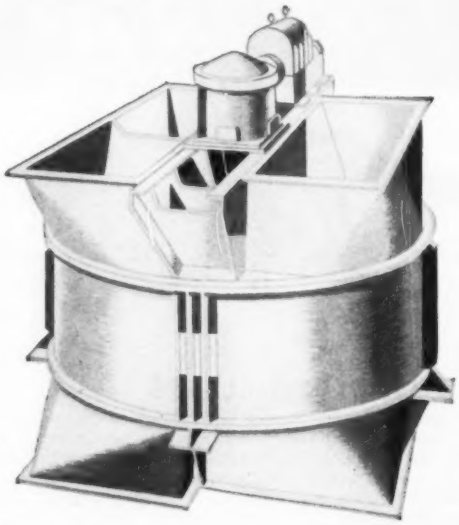
The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

Problems presented by today's available fuels hold fewer complications in those boiler plants equipped with Ljungstrom Air Preheaters.

High temperature combustion air is the key factor to efficient combustion of low-grade fuels, especially coals with high ash or moisture content. With the Ljungstrom Air Preheater it is possible to obtain higher preheat more economically.

In addition, the *continuous regenerative counterflow principle* of the Ljungstrom permits reliable operation at low exit gas temperature. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

If you are planning a new installation, or modernizing your present one, our engineers will welcome the opportunity to show you how the Ljungstrom can enable you to get better results from low-grade, less costly fuels.



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Which may be re-lamped from the ground; weather-tight seal without gaskets is permanent and effective.

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Ideal for 1000 and 2500 lumen lamps in Residential areas.

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Recommended for high intensity lamps in Business and Boulevard locations.

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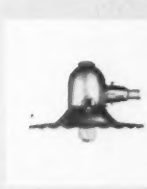
Available in Enameled Steel, Aluminum, or 18-8 Stainless Steel; Radial Wave in Enameled or Aluminum types.



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Most effective units for Defense Plant installations.

SEAMLESS TUBULAR STEEL POLES

We can furnish steel poles for various strength requirements and luminaire mounting heights.

PIPE BRACKETS AND MAST ARMS

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Complete Pole Line Equipment

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

(Photo courtesy Southern California Edison Co.)

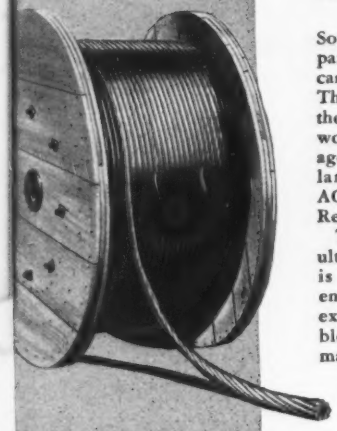
Imagineering Anniversary on Big Creek . . .

Southern California Edison Company's *Big Creek Line* gets a 38th candle on this year's birthday cake. The Big Creek Line is known the world over. At birth it was the world's longest and highest voltage transmission line . . ., and the largest installation of Alcoa ACSR (Aluminum Cable Steel Reinforced).

Today more than ever before, ultra-high voltage transmission is a major project with Alcoa engineers. Rearmament means expansion. Delivering bigger blocks of electrical energy demands bigger conductors and bigger conductors mean new installation problems.

Alcoa has been *imagineering;* working on these problems for over 30 years—anticipating the day when power companies may operate lines at voltages never before commercially practical. Alcoa's experience is at your service . . . whether your problems are today's or tomorrow's.

Although the rearmament program prevents unrestricted use of aluminum, we are ready to help you with the extensive study and planning required for power transmission projects.



TECHNICAL HELP—NO OBLIGATION

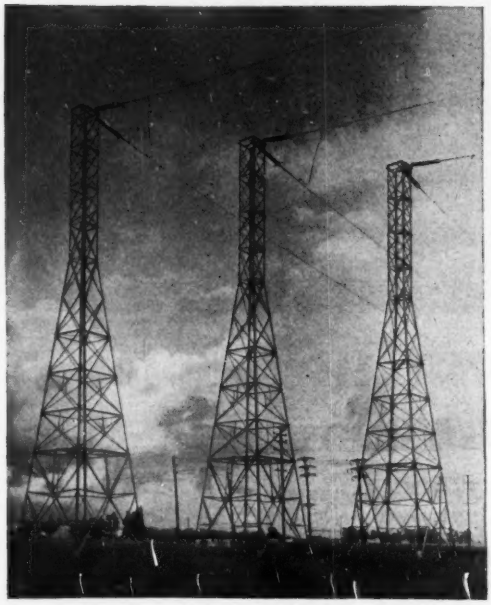
Write for help, advice or technical literature: ALUMINUM COMPANY OF AMERICA, 2100D Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM FIRST IN **A·C·S·R**

Aluminum Cable Steel Reinforced

Demand PROOF OF PERFORMANCE

for Superior Insulator Quality

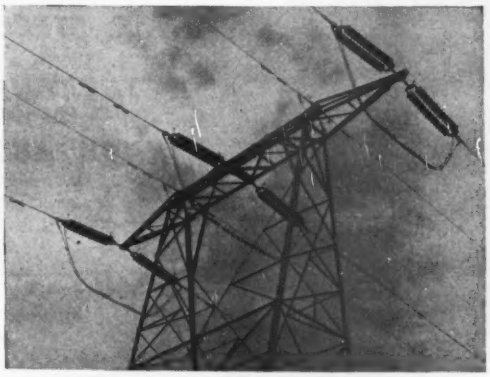


On right-angle towers, Thomas Insulators have the stamina that assures long life and trouble-free performance.

"Repeat Orders" are the best proof of insulator quality . . . and are the best evidence that all insulators are not alike.

Shown on this page are just two of the many Thomas insulator installations on the lines of one of the largest Western Utilities. For many years, this Customer has given us order after order. Such *repeat orders* from this and other companies are the best testimonials to the long life and outstanding performance of Thomas Insulators.

After all is said . . . it's still quality that counts plus proper designing, precision manufacturing . . . and PROOF OF PERFORMANCE. Throughout the world, Thomas Insulators have been establishing service records since the advent of the Electrical Industry. Why gamble?



Thousands of Thomas Insulators make certain that this 220-kv line will give satisfactory service for decades to come.

The R. Thomas and Sons Company is a manufacturer and designer of all types of porcelain insulators . . . pin-type, switch, suspension, spools, guy-strain, bushings and special high-voltage porcelain. In addition, Thomas supplies associated line hardware, clamps, fittings, preformed armor rods, and so on.

SPECIFY THOMAS INSULATORS—THE BEST BY LINE TEST

— Since 1873 —

The R. Thomas and Sons Co.

1873 THOMAS INSULATORS our 78th year RELIABILITY 1951

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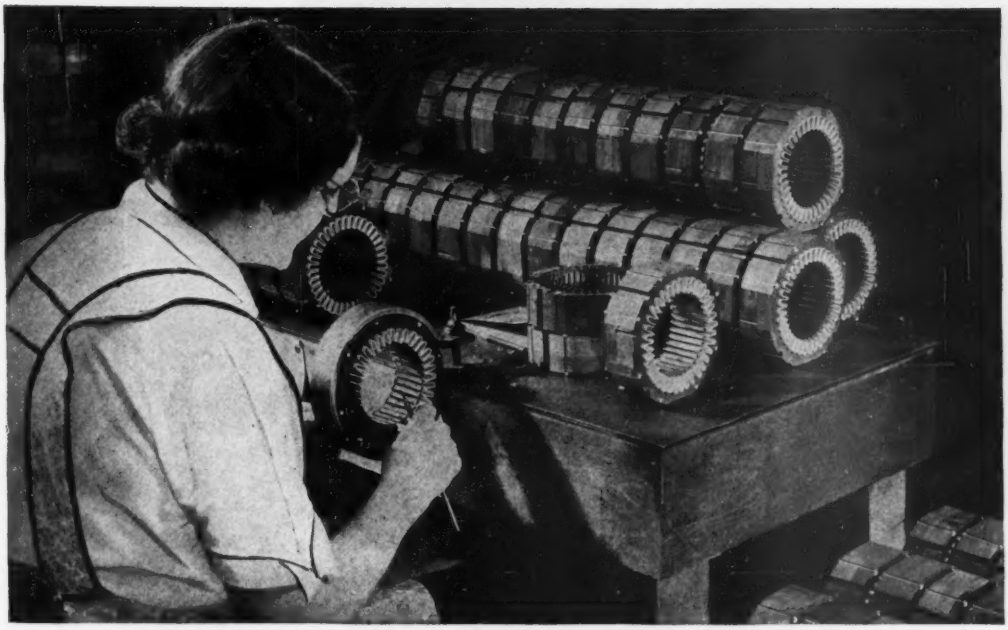
UNITED STATES STEEL



"Motors with IRV-O-SLOT insulation give year after year of service"

The Kingston-Conley Division of the Hoover Company uses Irvington IRV-O-SLOT insulation on its famous line of electric motors. Mr. A. E. Ott, Sales Engineer at Hoover, tells why:

"The high quality of the paper backing used in IRV-O-SLOT insulation has been fully proved by the many years over which our motors give satisfactory service. We find, too, that Irvington's slitting facilities give us greater flexibility in selecting paper widths, and allow us to shorten up our scheduling cycles."

These are among the reasons why IRV-O-SLOT has been the choice of many an electrical manufacturer, ever since Irvington introduced it as one of the *first* combined varnished-cambric-and-backing slot insulations.

The IRV-O-SLOT line now includes insulation for every slot requirement. Backing papers combine high dielectric and mechanical strength with ease of forming. Bonding adhesive allows enough "give" to prevent rupture of varnish film. IRV-O-SLOT literature is yours for the asking—just use the coupon below.

Send this convenient coupon now

Irvington
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Irvington 11, New Jersey

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6C Argyle Terrace, Irvington 11, N. J.
Gentlemen:
Please send me technical literature on IRV-O-SLOT insulation.

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...Your space requirements for serving these customers and maintaining your property must keep pace with the increase in the generating capacity of your system.

TO HELP maintain efficient service, utility companies can turn to Ebasco for help in getting the full facts about the space they need to keep their operations in balance as generating capacity is installed.

Because Ebasco's Space Planning Division has had long experience with this problem, they can save you time and money in finding the solution that is best for you.

First they make a space requirement survey based on present operations. This information is projected to predict space requirements for service and maintenance in terms of future growth. Knowing these facts will help make your plans more successful and maintain your service standards as your business increases. Initial consultation with Ebasco is without cost or obligation. Write for "The Inside Story of Outside Help," describing the Ebasco services available to you. Dept. M, Ebasco Services Incorporated, Two Rector Street, New York 6, N. Y.

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EBASCO SERVICES

INCORPORATED

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Ebasco Teamwork gets things done anywhere in the world

Now...tracking down hidden temperatures is simply a push-button operation

You'd hardly think a little thing like expansion could be so troublesome and costly in stored petroleum products. Yet temperature changes cause a change in volume that can amount to thousands of gallons annually, even in one tank.

When oil is sold from one of these tanks its average temperature must be known in order to compute the true amount. But accepted methods of checking temperatures leave much to be desired. Even in heated tanks, temperatures are far from uniform. The oil is cold below the coils, hot around and immediately above, progressively cooler near the top. To obtain an average, a gauger had to climb the tank in all kinds of weather, and spend up to an hour taking dip-cup thermometer readings at many levels.

Even with great care, this method could introduce errors in volumetric calculations amounting to hundreds of barrels per tank. Needed: an instrument to instantly indicate true, average temperature throughout the liquid.

Representatives of a large oil company brought this problem to Weston engineers. In answer, they developed a special resistance thermometer, with temperature-sensing elements extending down through the oil. Now Weston meters mounted outside the tanks give accurate, *average* temperatures at the push of a button.

The same direct thinking and sound engineering that tracked down these hidden losses are available at Weston to help solve measuring, recording or controlling problems whether involving electricity, light, pressure or temperature. Weston Electrical Instrument Corporation, 594 Frelinghuysen Avenue, Newark 5, N. J., manufacturers of Weston and TAGliabue instruments.

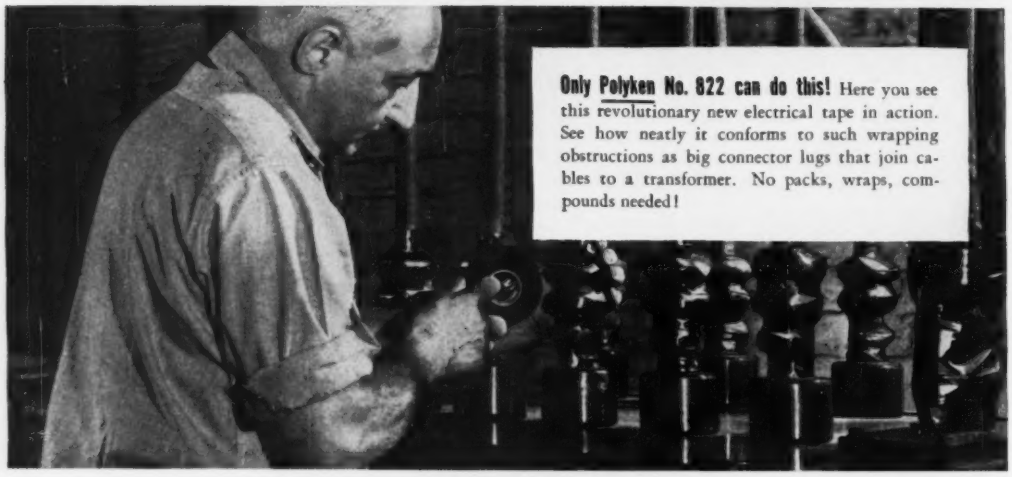
WESTON TAG **WESTON** *Instruments* TO INDICATE . . . RECORD . . . CONTROL

THE NEW

Polyken®

INDUSTRIAL TAPES

TAILORED TO YOUR JOB



Only Polyken No. 822 can do this! Here you see this revolutionary new electrical tape in action. See how neatly it conforms to such wrapping obstructions as big connector lugs that join cables to a transformer. No packs, wraps, compounds needed!

Now wrap high-tension cables in ONE easy step!

Until *Polyken* No. 822 was developed, wrapping high-tension cables was a two-step job. First, a rubber splicing compound, followed by an outer wrap of friction tape.

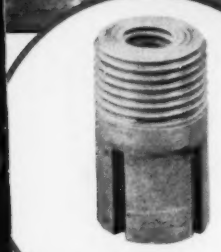
Now you can forget about the rubber compound! *Polyken* Electrical Tape No. 822 is only 9 mils thick—but it's 10,000 volts strong (dielectric strength). Makes *one* quick operation out of two tedious ones with no sacrifice of efficiency.

No. 822 is the only oriented polyethylene tape with a successful pressure-sensitive adhesive. Stretches both ways, so that it covers rough and irregular surfaces. High moisture resistance. Solvent proof. Corrosion proof. For splicing, wrapping, insulating, corrosion coating of cables, wires, controls, pipes, conduits, and hundreds of other uses. Write for free samples today!

GET FREE SAMPLES of *Polyken* No. 822, plus complete specifications and engineering data. Write *Polyken*, Dept. EWD, 222 West Adams Street, Chicago 6, Illinois.

Polyken Industrial Tape, Department of Bauer & Black, Division of The Kendall Company

TTR-49 CONTACTS...designed to take abuse...



A Service fault of... 10,000 Amperes for several seconds

followed by 6,000 Amperes for some minutes

Unretouched photo record of the Sealed Pressure Hinge Contact Pins which carried the fault current. The annular, spiral contact has ample mass area to store and carry off excess heating. The spring loaded, silver-to-copper contact surface, permanently coated with a sealed-in inhibiter, is thus fortified against such abnormal conditions.

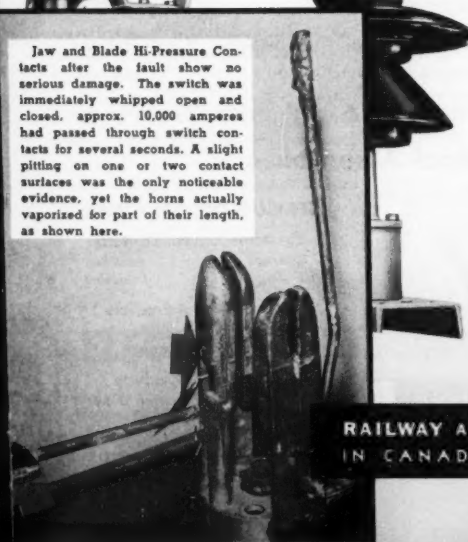
CHECK THE FACTS

"A grounded 34.5 Kv. 600 Amp. TTRA-49 Horn Gap Switch was accidently closed in on a hot bus, setting up a solid 3-phase ground on the system. A conservative estimate of the fault current was 10,000 Amp. In a few SECONDS generators totaling 100,000 KVA were tripped off. A fault current of about 6000 Amp. remained for 2 or 3 MINUTES until tripped manually."

The switch was replaced to study the effects of the short.

1. No serious damage to any contact parts during this extraordinary, severe punishment.
2. Both the Sealed Pressure Hinged Contacts and the Hi-Pressure Break Contacts were found remarkably clean and serviceable.
3. The switches operated freely immediately after the fault current had been cut off.
4. Thermal tests on the reassembled parts proved that the switch retained its maximum current carrying capacity with no excess temperature rise.
5. Here's proof of the thoughtful design and careful workmanship of TTR-49 switches—built to meet today's operating requirements, where greater fault currents are possible.

Jaw and Blade Hi-Pressure Contacts after the fault show no serious damage. The switch was immediately whipped open and closed, approx. 10,000 amperes had passed through switch contacts for several seconds. A slight pitting on one or two contact surfaces was the only noticeable evidence, yet the horns actually vaporized for part of their length, as shown here.



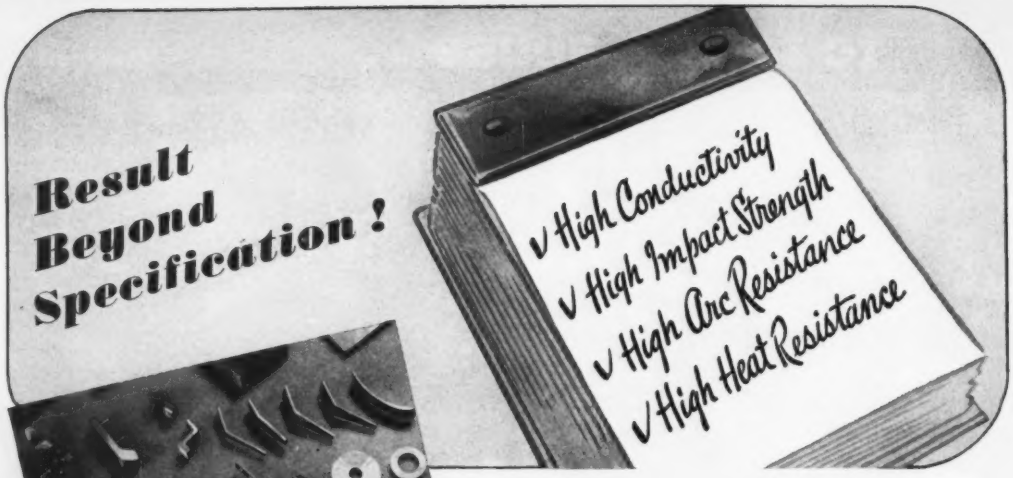
Check List

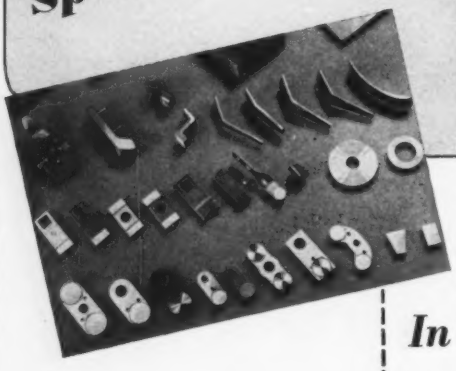
- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

AN I-T-E SUBSIDIARY

Result Beyond Specification!





Exclusive Techniques Assure Top Performance In Elkonite Contact Materials*

ELKONITE CONTACTS

Elkonite contacts are made by the only method which permits the combining of the desirable features of basic metals which cannot be alloyed. By this means, the high melting points of tungsten, molybdenum, or their carbides, can be combined with the current-carrying ability of silver or copper.

Elkonite materials are best known for their hardness, resistance to mechanical wear and impact, resistance to erosion by arcing, and resistance to sticking.

*Reg. U. S. Pat. Off.

**The ability of a contact material to withstand the erosion of an electric arc.

The secret of Elkonite superiority is the technique by which this composite material is made to retain such a high degree of the desirable properties of each of the constituent metals. Mallory engineers have so developed this art that no other contact material has equalled Elkonite in all four features that spell top performance every time . . . conductivity, impact strength, AR** factor, and heat resistance.

Thus, Elkonite . . . the result of precision compounding to take the best advantage of specific properties . . . can deliver an extra measure of satisfaction in service.

That's result beyond specification!

Mallory contact know-how is at your disposal. What Mallory has done for others can be done for you.

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

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Electromechanical Products
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Mercury Dry Batteries

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Contacts *Special Metals*
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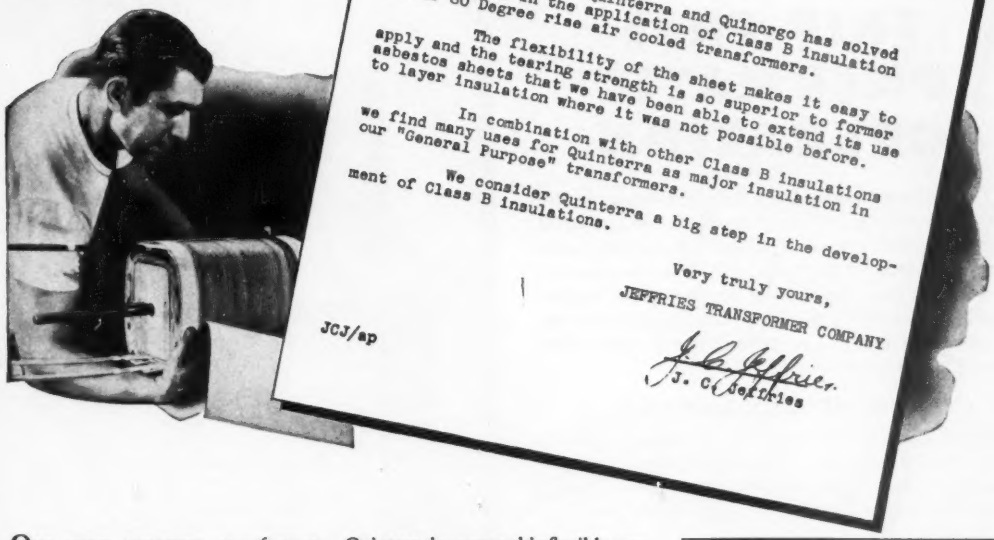
"We consider *Quinterra* a big step in the development of Class B insulations . . ."



JEFFRIES TRANSFORMER CO.
TRANSFORMERS ✣ ELECTRICAL WINDINGS
1710 EAST 57TH STREET • Phone LAfayette 5187 • LOS ANGELES 11, CALIFORNIA

September 14, 1949

Johns-Manville
816 W. Fifth Street
Los Angeles, California

Attention of: Mr. Paul Kriksous

Gentlemen:

The use of Quinterra and Quinorgo has solved many problems in the application of Class B insulation to our 80 Degree rise air cooled transformers.

The flexibility of the sheet makes it easy to apply and the tearing strength is so superior to former asbestos sheets that we have been able to extend its use to layer insulation where it was not possible before.

In combination with other Class B insulations we find many uses for Quinterra as major insulation in our "General Purpose" transformers.

We consider Quinterra a big step in the development of Class B insulations.

Very truly yours,
JEFFRIES TRANSFORMER COMPANY

JCJ/ap

J. C. Jeffries

ONE AFTER ANOTHER, transformer companies like Jeffries are "discovering" Quinterra—the revolutionary, new Johns-Manville purified asbestos, high-temperature, electrical insulation.

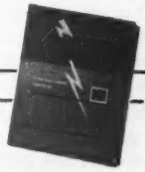
. . . And, like Jeffries, they're discovering that Quinterra in a transformer gives them important selling advantages . . . as well as providing many savings in transformer design and production.

Quinterra is a paper-thin flexible, continuous sheet insulation. It is being widely used for interlayer and wrapper insulation in transformers and coils.

Its lasting dielectric strength, due to its resistance to pyrolysis, assures a greater safety factor and longer operating life. Quinterra withstands substantially higher temperatures than the hot-spot limit of 130C for Class B insulations.

QUINTERRA

- ✓ **cuts factory rejects**
- ✓ **reduces complaints**
- ✓ **improves production rate**
- ✓ **produces more uniform product**
- ✓ **cuts costs of operations**



Johns-Manville
ELECTRICAL INSULATIONS

Johns-Manville
Box 290, New York 16, N. Y.

Kindly send me a copy of
Johns-Manville Quinterra Electrical Insulation EL-34A.

Name_____

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Get Full Electrical

WITH MECHANICALLY TRIP-FREE PNEUMATIC OPERATION

YOUR CIRCUIT BREAKER is a long term investment that pays dividends daily in protection for your electrical system. Naturally, you want full electrical protection — the best protection your money can buy. That's an important reason why your pneumatically operated circuit breakers should be mechanically trip-free. Unless they're mechanically trip-free they may fail to reopen properly when closed against a fault condition.

TRIP-FREE ADVANTAGES

Opening action of Allis-Chalmers pneumatically operated breakers is immediate and positive, because tripping instantly uncouples contacts from the closing mechanism. Opening occurs whether the breaker is in normal closed position or is "closing in" on a short circuit.

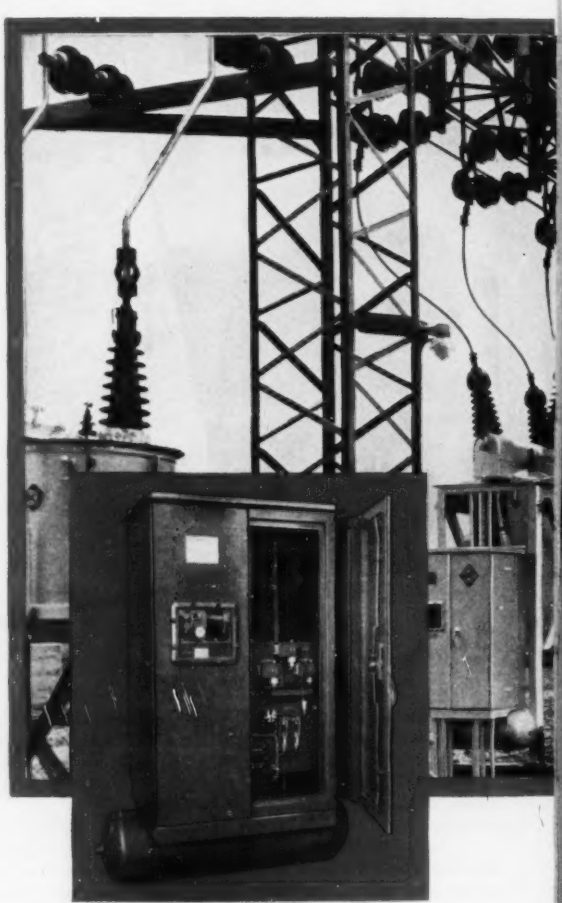
Breaker opening is independent of the closing piston and air valves. There is no drag from the closing mechanism.

Designed for high speed (20 cycle) reclosing, these breakers combine fast acting power of pneumatic operation with fast recoupling of contacts and reclosing mechanism. Stored energy for fast closing comes from a self contained air pressure tank with compressor.

You can gain the advantages of mechanically trip-free operation in every Allis-Chalmers power oil circuit breaker — whether pneumatically, solenoid or manually operated. It is standard in all sizes and ratings.

More than one-half century of experience stands behind the dependable operation of these breakers, serving industry since 1899. This dependability is being proved daily in utility and industrial installations coast to coast.

Call your Allis-Chalmers district office for more information on power oil circuit breakers. Or write Allis-Chalmers, Milwaukee 1, Wis., for your copy of the mechanically trip-free pneumatic operator bulletin. A-3335

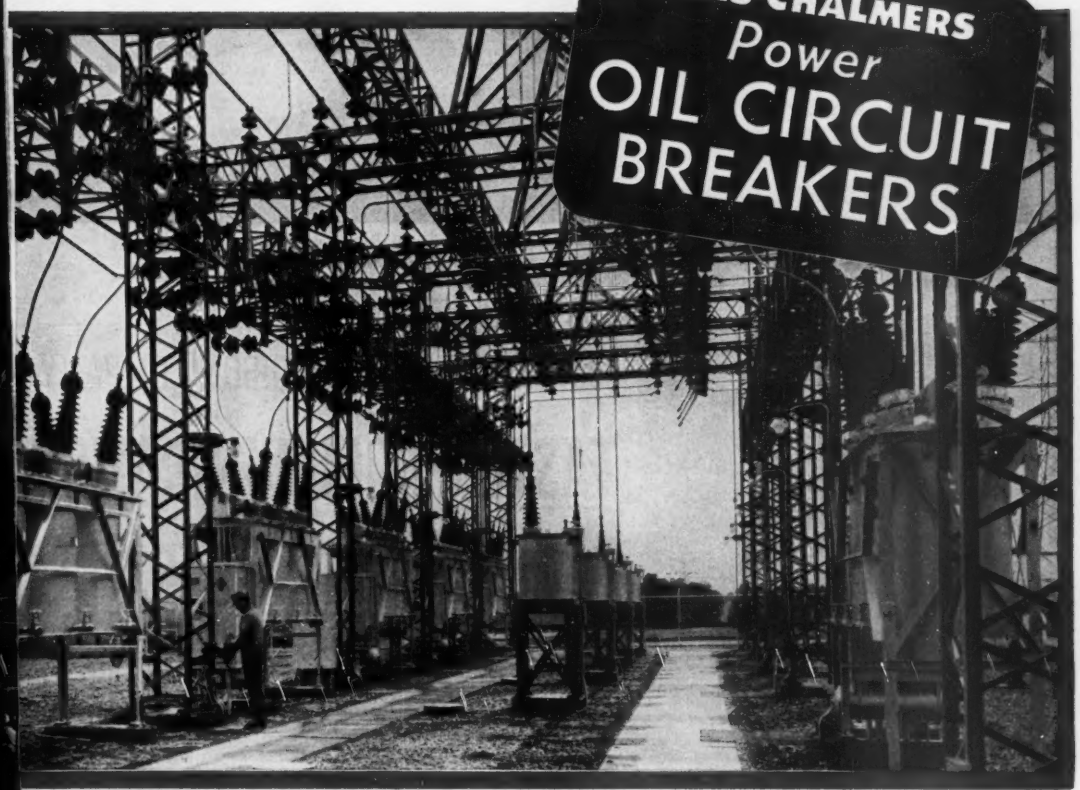


Weatherproof operator housing furnishes double protection against moisture.

For keeping out wind-driven weather, double doors with full length hinges are recessed. They have provisions for gasketing. The large safety glass window in the door permits a quick check of air pressure gauge, position indicator, operation counter and nameplate.

The operator is protected against condensation. The air tank is outside of housing. Thermostat controlled electric heaters keep both the operator and housing interior above ambient temperature. All parts are rustproof.

Protection



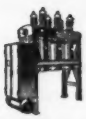
These FZO-151 circuit breakers are equipped with the reliable mechanically trip-free pneumatic operator. The *Ruptor* interrupting device and many other important features also contribute to your assurance of positive operation. The FZO-151 is rated 69 kv up to 3,500,000 kva with 8 to 5 cycle opening, 20 cycle reclosing.

Ruptor and *Unitop* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

MECHANICALLY TRIP-FREE PNEUMATIC OPERATOR IS STANDARD EQUIPMENT ON ALL THESE ALLIS-CHALMERS OUTDOOR POWER OIL CIRCUIT BREAKERS



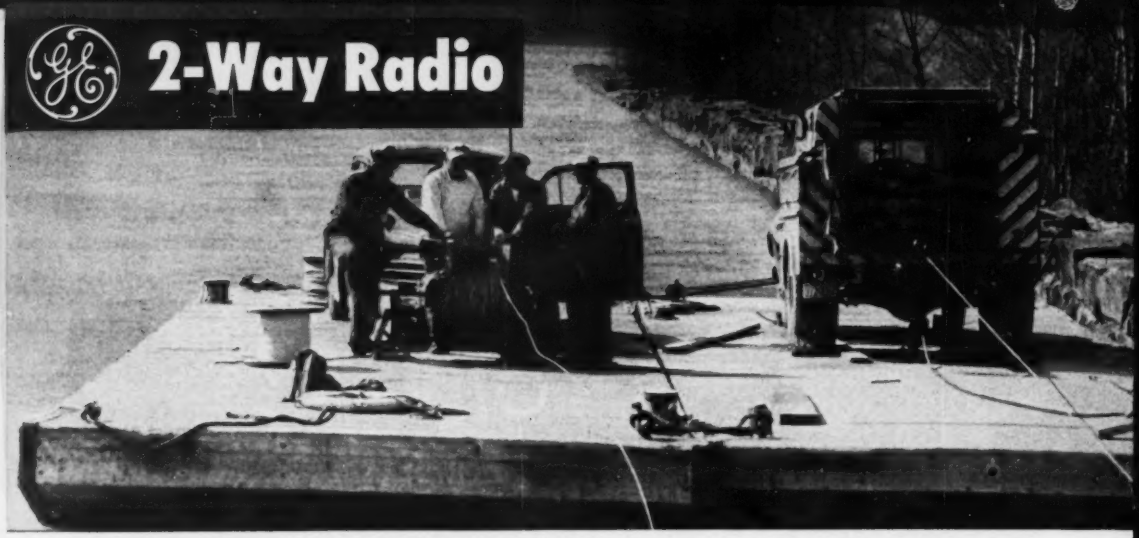
Type FZO-150 *Unitop* breaker 14.4 to 46 kv, 8-cycle opening, 20-cycle reclosing*

Type FZO-151 . . . 69 kv, 5 or 8-cycle opening, 20-cycle reclosing*

Type BZO-160 . . . 69 kv, 8-cycle opening, 115 to 230 kv — 3 or 5-cycle opening with 20-cycle reclosing*

*20-cycle reclosing standard for 600 and 1200 amp breakers

2-Way Radio



Stringing conductor for 114,000 volt line from a barge in the Susquehanna River. Truck pulls wire from center of river because electrified railroad tracks on both banks prevent proper start from ground. General Electric 2-way radio in car on barge facilitates river-to-shore communication, greatly reduces danger to personnel.

Remote station transmitter is used by the foreman who makes his radio report from a distance of 40 miles. Compact, shelf-mounted unit has a power output of 50 watts.

Lineman's confidence is increased when voice contact with dispatcher is as near as the mike on the dashboard. Reports and instructions are exchanged instantly by General Electric 2-way radio.

At METROPOLITAN EDISON COMPANY

FASTER COMMUNICATION MEANS BETTER SERVICE!

Pennsylvania Utility Uses General Electric Mobile Radio for All-Year Dependability

LIKE all companies that sell service, electric utilities fight a common enemy—time. To reduce the time lag between outage and restoration, to give better service to the customer, is a constant, year 'round problem.

General Electric has the answer. It is *mobile radio*—2-way voice communication *instantly*—from car to car in motion, or between fixed and moving points. G. E.'s FM radio beam needs no wires, rides above static, brings in voices clearly and evenly in any weather.

It is a matter of record that G-E radio systems are cutting costs for utilities every day. Metropolitan Edison of Pennsylvania is one enthusiastic customer. You'll find others in all sections of the United States and Canada.

G. E. will survey and engineer to fit your terrain and your individual needs. If you're looking for better, faster methods of communication, get in touch with us. *General Electric Company, Electronics Park, Syracuse, New York.*

Faster dispatching by radio routes service vehicles to jobs with minimum delay, increases overall efficiency. Utilities everywhere have used General Electric radio for years, consider it an indispensable tool in all mobile operations. Frequently, the time and money saved in one emergency pays for the entire radio system.

Emergency use of radio is illustrated where wire is repaired after severe sleet storm in eastern Pennsylvania. G-E radio in truck, right, was only communication between workmen and dispatching office.

Immediate action in any weather is an important feature of G-E radio equipment. Delay is costly to utilities, can be minimized by 2-way system.

District Operating Superintendent Clyde Lenhart keeps in touch with river crossing operation via car radio from east bank of Susquehanna.

FOR CIVIL DEFENSE, *too, your radio system can contribute to public safety. Your G-E communications man will explain how. Ask him about it.*

FREE—Complete Information Kit on G-E 2-way radio systems and how they operate to your advantage. We will send your copy on request. Write *General Electric Company, Section 1941-23, Electronics Park, Syracuse, New York.*

You can put your confidence in—

GENERAL ELECTRIC

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

NEW

Early in March the Duke Power Company placed in service one of the two units which comprise the first section of their new Lee Station near Pelzer, South Carolina.

Named in honor of Mr. W. S. Lee, former vice president and chief engineer of the Duke Power Company, this fine modern station is located on the Saluda River in the highly developed industrial area on the southwestern end of the Duke Power System.

The first of the two 90,000/100,000 kw turbine-generators is now on the line, and the second is nearing completion. It is anticipated that both units will be in regular service by mid-summer.

Both turbine-generators, which are of the reheat type, are served by C-E Steam Generating Units employing the highly favored one-boiler, one-turbine arrangement.

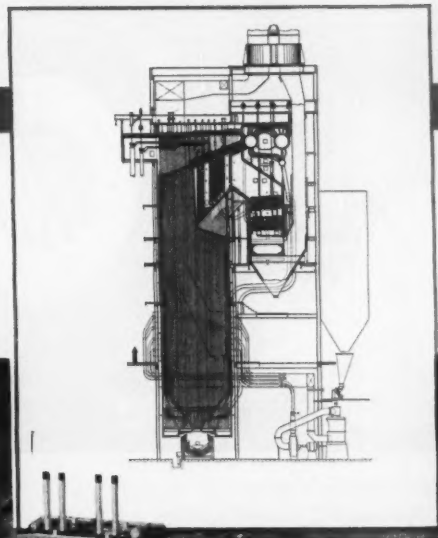
A cross-sectional elevation and brief description of one of the C-E Steam Generators appears on the opposite page. B-482

C-E

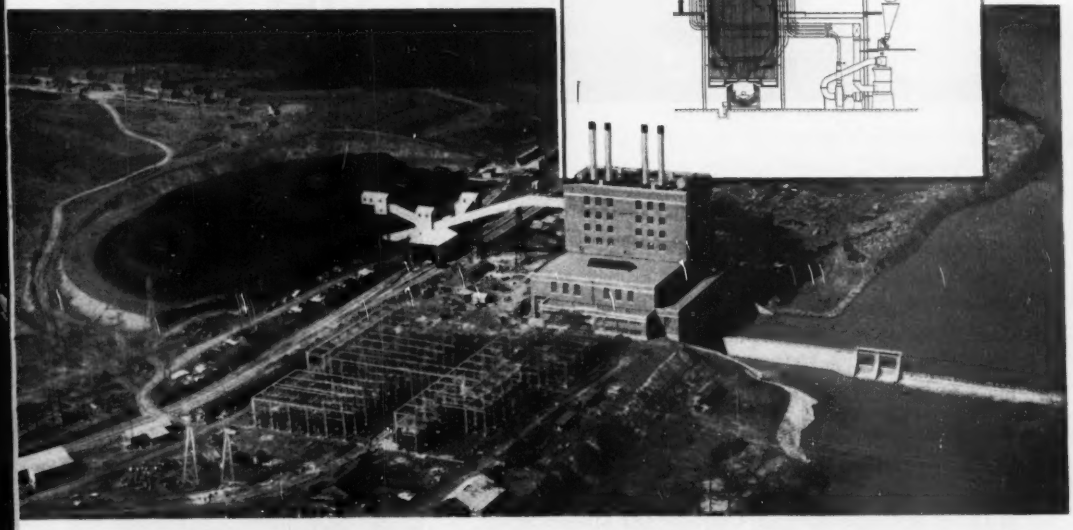
COMBUSTION

200 MADISON AVENUE, NEW YORK 16, N. Y.

Lee Station goes into service



The cross-sectional view at the right shows one of the two duplicate units which comprise the first section of the Lee Station. It is of the reheat, radiant type with a reheater section located between the primary and secondary superheater surface. A finned tube economizer is located below the rear superheater section, and regenerative air heaters follow the economizer surface. The unit is designed for pulverized coal firing employing bowl mills and tilting, tangential burners. Steam is supplied at a throttle pressure of 1250 psi at 950 F and is reheated to 950 F.

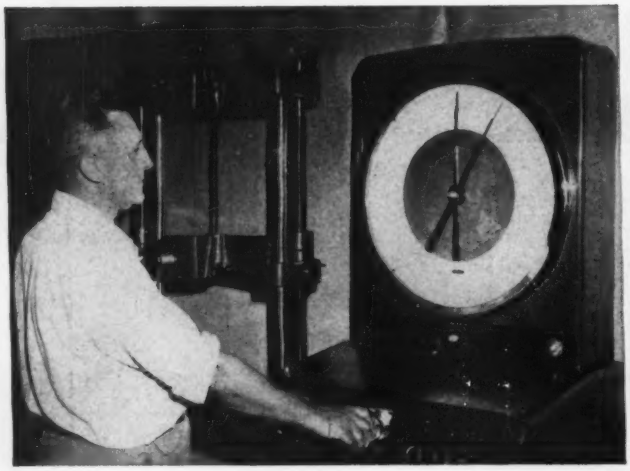


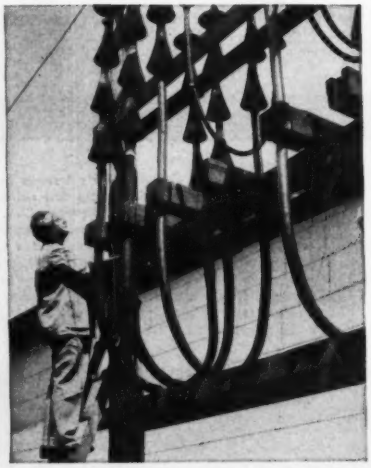
ENGINEERING—SUPERHEATER, INC.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Fine Engineering

protects the long life inherent in Kerite Cable





Sound, resourceful engineering-development is a contributing factor to the technical superiority of Kerite Cable.

Never-ending research in Kerite's engineering laboratories produces new, better ways to protect cable; new types of cable and new ways to make use of time proven Kerite insulation. Fine engineering, conscientious workmanship, and proper handling combine to protect the long life that is inherent in all Kerite insulated cables.

Kerite engineers will be glad to help you with your cable problems, whatever they may be. THE KERITE COMPANY, 30 Church Street, New York 7, N. Y. Offices also at 122 S. Michigan Avenue, Chicago; 582 Market Street, San Francisco; 39-01 San Fernando Rd., Glendale 4, Calif.

KERITE CABLE

Kerite Insulation—Your Cable's Best Life Insurance

Editorials

The Last Bumper Crop—Lost?

Utilities this spring are losing their chance at a fair share of the last bumper crop of engineering graduates for half a decade or more. It is indeed ironical that neglect lies as close as it does to the root of the trouble in an industry justly proud of its reputation for preparedness. Yet, the fact remains that other industries are "walking away" with the best of the 1951 engineering graduates because too few utility recruiters are in the field, because the starting pay they offer is too low, and because the utility recruiting story has become "old hat."

This is the situation as it is reflected in the reports of veteran utility recruiters and educators. It is not a happy picture, but it is one that can be changed by direct, positive action by individual utilities. Certainly, it must be changed if the industry is to execute successfully its expansion program.

This year is a critical one for the recruiting of engineering graduates. Not only is more recruiting being done now by all industry, but when this year is past the annual crop of engineering graduates will drop to 21,000 in 1952, 17,000 in 1953, and 12,400 in 1954—even before the draft takes its toll. At this rate of decline the United States will accumulate a deficiency of 40,000 engineers by 1954.

Realizing this some companies, with a steady demand for engineers, are applying the "yo-yo" principle to the hiring of draft-eligible students; hiring them and letting them go into service now in order to get them back later when the shortage of engineers is certain to be much greater than at present.

Fortunately, present defects in utility recruiting activities are not insurmountable. But direct and immediate action along these lines is vital if the industry is to get and hold the pick of the young engineers:

1. Recruiting activities must be intensified. Most companies are calling at less than a half dozen schools. Yet, this spring recruiters are having to make two to three offers to get one man. The number of interviews per offer is much higher. Clearly this calls for a stepped up recruiting activity.

2. To compete with industries that are offering $300 a month and up, to start, the utility starting pay must be increased sharply.

3. The utility recruiting story must be modernized. It is obsolete today. Graduates are going to industries where they believe the chance of advancement is strong, where they do not face long periods in engineering clerkships with little chance for self-expression. Enlightened utility recruiters recognize this and are stressing the opportunity that lies in a vital and expanding industry. Their story sparkles with examples of the rapid rise of bright young men in the utility industry today. They play up the security of employment in utility jobs but are careful not to oversell it. Security today is far from an exclusive utility job inducement and so has lost much of its appeal of former years.

Three things are apparent—utilities face a shortage of manpower in the next five years. The recruiting story being told by utilities today is not a strong one, nor is industry recruiting vigorous enough for the need. But fortunately, the situation is not without hope if the industry faces up to the weakness of its story, acts strongly, but above all acts now. Today we are missing the boat. . . .

Teach Children the Facts of Light

In some schools children are now being taught the facts of light and sight. When these children have grown up and take charge of things, they will see to it that their children have proper lighting to study by at home and in school. And crippled eyes will be a little fewer tomorrow than today.

The number of people needing crutches for their vision would be much fewer tomorrow if many more, if all, children were now being taught light and sight. The teaching material is available. All that has to be done is put it into use.

Some electric utilities are doing an excellent job of getting this material into the schools in their service areas. They are buying it from the Better Light Better Sight Bureau and selling the idea of using it to teachers and other school officials. In some places the idea has been sold so well that school authorities are now buying the material direct from the bureau.

In no other field can the electric utility find the two aims of selling so excellently combined as in education of the coming generation in lighting. It assures a grow ing use of electricity over a long period. Its benefit to the people served is tremendous, so great in fact, that this value alone justifies the utility in the effort and expense of selling the idea.

Selling the idea of education in lighting goes hand in hand with selling school and home lighting. Each complements the others. Here is triple-barrelled selling of the highest order, a kind of utility commercial activity that can be carried on effectively in at least its educational phase even during a time of restrictions, shortages, and controls.

Eta Kappa Nu Award

Outstanding young electrical engineers of the United States have been recognized and presented awards by Eta Kappa Nu, national honorary electrical engineering association, since 1936. For each succeeding year an award has been made for "meritorious service in the interest of their fellow men." In addition to the 15 young engineers who were called "outstanding" 37 others were chosen for honorable mention.

Significant is the fact that the recognition awards have been made to men in electrical manufacturing, educational institutions, government organizations, aircraft manufacturing, editorial work, and research laboratories, and only one (an honorable mention) to an electric utility engineer.

Nominations are now being made for the recognition award. Candidates must be less than 35 years, be not more than 10 years out of college (baccalaureate degree), and have been graduated from a recognized school of electrical engineering in this country or Canada. They must have outstanding records of professional achievement and community service.

Many young electrical engineers in the electric utility field are undoubtedly eligible for the nomination. An award or an honorable mention will be an added stimulant to further efforts and will also bring recognition to the utility.

Must an Engineer Do That Work?

A forgotten method of combating the shortage of engineers has been resurrected by H. N. Muller, Westinghouse Electric Corp. Speaking at the recent meeting of the Engineering and Operation Section of the Southeastern Electric Exchange, he advised his audience to avoid using engineers on work others can do.

There is much to say for Muller's solution. To start with there is no serious shortage of older engineers. We have heard of few utilities, engineering firms, or manufacturers who are in difficulty because of inability to find men to be chief engineers or to fill other positions in the higher echelon. The shortage is in younger men. Just how much of the work to be done by these men must be done by an engineer?

Industry was spoiled during the depression. There was an abundance of engineers. To get work many were willing to take minor jobs at low pay. And jobs that had been handled satisfactorily for years by non-technical men were suddenly filled with graduates of engineering schools. But if engineers are in short supply, industry should reevaluate its many tasks and give back to the non-engineer the jobs he can do.

Traffic Counts Are a Selling Aid

Today the electrical industry is faced with probable shortages in consumer wiring and utilization equipment. But the utility can still sell lighting by showing the customer the advantages of making full use of his existing "Lighting for Selling." Many customers now burn only a portion of their lights during part of their open-for-business hours. Some also turn off their show window and sign lighting while there still are prospective buyers passing. These customers, of course, are not making effective use of their existing lighting, and at the same time the utility is losing kwhr which are mainly off-peak and can easily be supplied with existing generating and distribution facilities.

The problem is to convince the customer that he cannot afford to continue such operations by showing him:

1. The prospective business he is *not* attracting with his present method of using his lighting.

2. The small additional operating cost required to make *full* use of the pulling power of light.

By turning to page 148 in this issue and reading the article by John D. Haverkamp, New Orleans Public Service, Inc—"How Traffic Counts Can Build Lighting Revenue"—you can find out how one company solved this problem.

The Electrical Week

INDUSTRY MOBILIZATION—CMP, effective July 1, will mean little change for the electric industry (p 88) . . . R. F. Sentner, executive vice president of the U. S. Steel Corp, has been named deputy director of NPA's Iron and Steel Division (p 88) . . . Depa is asking utilities to file statements of their orders for heavy power equipment on a new form, DEPA-5 (p 89) . . . Production of electrical appliances this year will fall below that of 1950 but not by much, ODM Director Charles E. Wilson told President Truman (p 89) . . . Because the aluminum manufacturers have been complaining, Depa is now urging utilities to use DO's on aluminum orders whenever authorized (p 89) . . . NPA has divided its Power Equipment Division into an Engine and Turbine Division and an Electrical Equipment Division. The change is effective July 1 (p 90) . . . Three Depa officials have been delegated to handle DO priority ratings under NPA's M-50 order (p 90) . . . Rooms and phone numbers of some PED sections have been changed (p 90) . . . Amendments to Industry M Orders are listed on Page 90 . . . Battery materials are scarce (p 90).

WASHINGTON—FPC denies Interior's motion to stay issuance of license to Vepco for development of Roanoke Rapids site (p 93) . . . REA sets new standard specifications to provide for heavier lines (p 94) . . . FPC issues 50-year license to Niagara Mohawk Power Corp for construction of dam on Raquette River in New York (p 97).

ELSEWHERE—Debt money will cost utilities more, EW finds (p 91) . . . Industry coordination and planning stressed at 18th SEE Conference (p 92) . . . Peaking deficiency of 250,000 kw is forecast at NPPA annual convention (p 94) . . . BPA economist says defense production will require 1.5 million kw of Northwest power by 1955 (p 95).

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A recent total of 648 cases of non-compliance with NPA orders indicated that most of the cases were unintentional, resulting from misunderstanding and misinterpretation.

February sales of electrical goods wholesalers went contrary to seasonal expectations and fell off 8% from January. Sales were 50% over February, 1950, Bureau of the Census figures indicate.

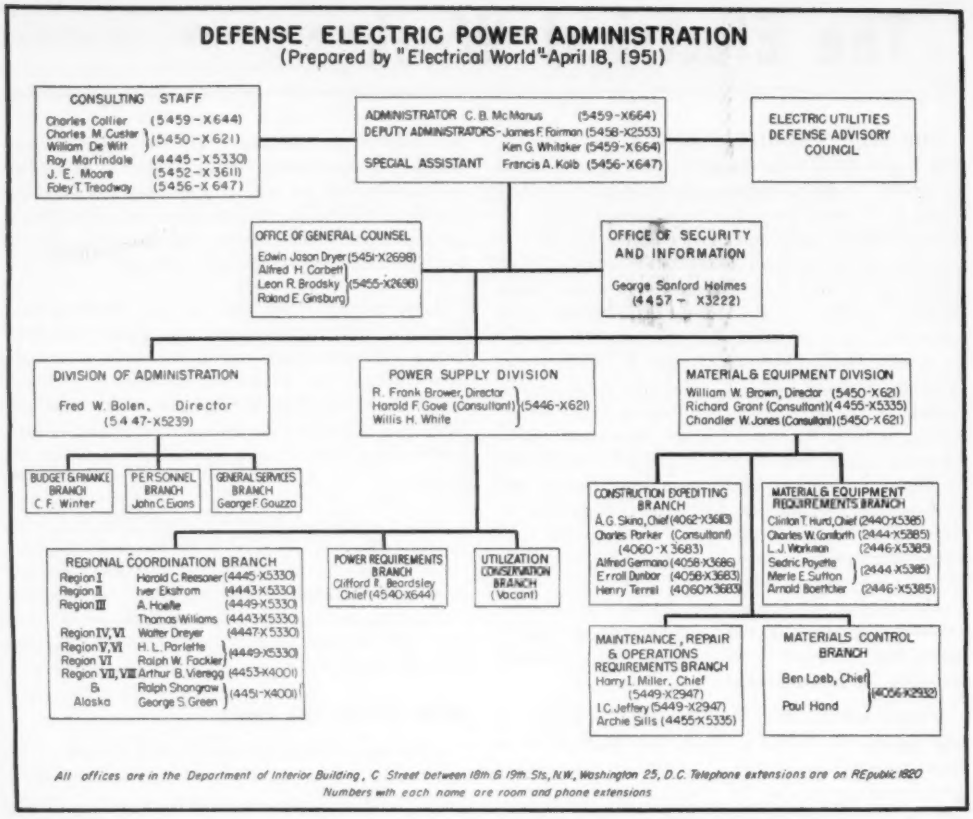
Tests of the Portsmouth mercury-steam plant of the Public Service Co of New Hampshire prove beyond reasonable doubt that this is the most efficient steam station of its size in the world, asserts Pres. A. R. Schiller. In a two-day run on fuel oil, and when operating at a load of 43,170 kw, fuel consumption was only 9,106 Btu per kwhr, preliminary figures indicate. This was 105 Btu better than General Electric's guarantee.

Heavy power equipment makers didn't have a chance to enjoy their new allocation system for basic metals before a plague of shortages in minor materials broke out. Allocation of steel, copper, and aluminum is working all right, manufacturers told NPA. But they asked for help getting tuluol, styrene, plastic films, resins, tape, and other insulating materials.

First international hydroelectric project to receive Marshall Plan aid will be a 96,000-kw plant to be constructed on the Inn River between Austria and Bavaria. Economic Cooperation Administration is supplying $540,000 for purchase of U. S.-built construction equipment, while $28 million will be financed by the Austrian-Bavarian Power Co.

Notes From The News

A bill to exclude REA co-ops in California from the jurisdiction of the Public Utilities Commission has been killed by the lower house of the California legislature . . . A four-day trial run of a new 60,000-kw turbogenerator was completed earlier this month at the South Chicago Plant of U. S. Steel Co. The generator is the largest of its kind ever built for industrial power production . . . Britain's Fuel Ministry has lifted the dimout order imposed on electric advertising signs and shop window lights . . . Power to 100,000 residents of Orizaba, Mexico, was cut off two hours last month when a vulture flew into high tension wires . . . The Bureau of Reclamation has closed the area on the Colorado River just above and below Davis Dam to boating, fishing, and other water sports as a public safety measure. The waters near the dam are turbulent and boats are in constant danger of capsizing . . . Utilizing the wind for power production is gaining new interest in Europe. The Organization for European Economic Cooperation is urging its members to step up studies on scientific site location and the relative merits of windmills versus propeller-driven air turbines. OEEC believes Britain and France can produce as much power by wind utilization as by all other means combined in some areas and at half the present cost.


DEFENSE ELECTRIC POWER ADMINISTRATION
(Prepared by "Electrical World"-April 18, 1951)
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SPECIAL ASSISTANT Francis A. Kolb (5456-X647)
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Thomas Williams (4443-X5330)
Region IV, VI Walter Dreyer (4447-X5330)
Region V, VI H. L. Parlette, Region VI Ralph W. Fackler (4449-X5330)
Region VII, VIII & Alaska Arthur B. Vieregg (4453-X4001), Ralph Shongrow, George S. Green (4451-X4001)
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Arnold Boettcher (2446-X5385)
MAINTENANCE, REPAIR & OPERATIONS REQUIREMENTS BRANCH
Harry I. Miller, Chief (5449-X2947)
I. C. Jeffery (5449-X2947)
Archie Sills (4455-X5335)
MATERIALS CONTROL BRANCH
Ben Loeb, Chief, Paul Hand (4056-X2932)
All offices are in the Department of Interior Building, C Street between 18th & 19th Sts, N.W, Washington 25, D.C. Telephone extensions are on REpublic 1820
Numbers with each name are room and phone extensions

CMP, Effective on July 1, Will Mean Little Change for Electric Industry

The long-expected announcement that a Controlled Materials Plan (CMP) would be established beginning with the third quarter, July 1, was made April 13 by National Production Authority Administrator Manly Fleischmann.

For electric utilities and electric power equipment makers CMP promised less change than for most other industries. Both already are being programmed for the materials which will be under CMP—aluminum, copper, and steel.

The new CMP will be familiar to most industry. It's based on the World War II CMP, right down to terminology and form numbers. Most items of heavy power equipment are on a tentative list of "B" products for which authorizations for materials will be given directly to producers.

The tentative list will be firmed up by May 1 when the big job of getting reports from most of American industry will begin. Third-quarter requirements for electric utility construction have already been compiled by Interior's Defense Electric Power Administration, while equipment makers' needs are being drawn up by NPA's Power Equipment Division.

The new CMP was planned under the direction of Walter Skuce who was in charge of CMP in World War II. Skuce, who was with General Electric Co for 10 years before going to the War Production Board in 1942, has been with Owens-Corning Fiberglas Corp since the war. He came to NPA several months ago to plan CMP and has been named assistant administrator of the agency in charge of production controls and CMP.

The "open end" of the CMP plan is where the headaches are already developing. After military and essential civilian production are accounted for, how much will be left over for consumer durables? Fleischmann said the answer would be made by a different approach, with Defense Mobilizer Wilson or perhaps the White House deciding what level of production is to be maintained. When the decision is made, it may mean cutbacks in allocations to more essential programs.

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R. F. Sentner Joins NPA

Richard F. Sentner, on leave as executive vice president of U. S. Steel Corp, has been named deputy director of National Production Authority's Iron and Steel Division.

H. C. HOOVER, formerly of Potomac Electric Power Co and Wagner Electric Corp, chief of Program & Statistics Section of NPA's Power Equipment Division

H. I. MILLER, Wisconsin Public Service Corp, is head of the Maintenance, Repair, and Operation Branch of the Material and Equipment Division of Depa

DEPA-5 to Be Used for Reporting Heavy Power Equipment Orders

Defense Electric Power Administration is asking electric utilities to file statements of their orders for heavy power equipment.

The action was taken to give Depa information for working with the National Production Authority on requests made by utilities for materials under Depa's EO-1. On a new form, DEPA-5, electric utilities must list heavy power equipment orders, with capacity, manufacturer, purchase-order number, manufacturer's order number, and manufacturer's promised shipping date. Separate DEPA-5 forms are to be submitted for each construction project using heavy power equipment.

Types of equipment on which utilities must report orders include: Steam-turbine, ac-generator sets; gas-turbine, ac-generator sets; diesel-engine, ac-generator sets; steam boilers; transformers with capacity of 501 kva and over for operation above 15 kv; hydraulic turbines; hydraulic-turbine generator sets; high-voltage, metalclad switchgear containing circuit breakers over 15 kv; low-voltage, metal-enclosed switchgear containing circuit breakers rated 2.2 kv to 15 kv; and circuit breakers of 2,200 v or higher.

Form DEPA-5 will show the filing of a DPA-2 form (statement of construction project) for each project, or the utility must explain why a DPA-2 was not required, as in the case of minor plant additions.

Depa has been "reviewing and recommending adjustments" in the schedules of power equipment makers which are under the jurisdiction of NPA's Power Equipment Division.

Other amendments to Depa's EO-1:

Define "plant addition" and reemphasize that additions may not be combined or subdivided for Depa reports.

Exclude office buildings and similar structures from major plant additions over which Depa has jurisdiction. (This type of construction is now to be reported directly to NPA in accordance with NPA's M-4 order.)

Formally ordered filing of Form 3-S (steel requirements) although 3-S forms have been previously filed by utilities.

Asked for additional information on conductor requirements.

Ordered forms DPA-2, DPA-3, and DEPA-3-S filed "at least four months prior to the earliest quarter in which receipt of critical materials is required," instead of four months before receipt of the materials is expected.

Provided for filing of amendments to DPA-2 forms.

Wilson Sees Slight Drop in Appliance Production

Production of electric appliances this year will fall below the record output of 1950—but not by much. At least, that's the way Defense Mobilizer Charles E. Wilson figures it.

Wilson's first report to President Truman—for the first quarter of 1951—emphasizes the continued high level of production of most consumer goods, despite materials shortages. For most consumer items, production was even higher during the first quarter of 1951 than in January-March 1950, the defense mobilizer states.

Wilson's Office of Defense Mobilization estimates this year's output of some specific appliances as follows:

Radio receivers, same as 1950, about 14 million units.

Television sets, slightly under last year, but about 6 million units.

Refrigerators, also down slightly, just under 6 million.

Washers, down from more than 4 million to about 3 million.

The appliance outlook for 1952 is not so bright. Military production will be chewing up more of the raw materials used in appliances. But, Wilson concluded, "Few goods will disappear completely from the market, as some did in World War II."

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Depa Urges Utilities Use Aluminum Order DO's

Electric utilities are being urged by Defense Electric Power Administration to use Defense Order (DO) ratings on aluminum orders wherever authorized.

Depa declared April 13 that aluminum producers were complaining that the utilities were not using the DO's on their orders. The Depa statement followed a meeting in Washington between officials of Depa and the National Production Authority and representatives of the three largest aluminum producers, Aluminum Co of America, Reynolds Metals, and Kaiser Aluminum & Chemical Corp.

Failure of electric utilities to apply DO ratings to conductor orders is holding up second quarter production, the producers complained to Depa. Under M-50, DO's on electric utility orders to fabricators are passed on to the producers.

P. J. ROBINSON, General Electric Co, is chief of the Steam Turbine Section of the Power Equipment Division of NPA

G. J. ROEWE, Rural Electrification Administration, chief of Conservation Section of NPA's Power Equipment Division

PED Divided in New NPA Setup; Stone Is Assistant Administrator

Reorganization of the National Production Authority's industry divisions beginning July 1 along the lines forecast by "Electrical World" (EW, March 26, p 89) was confirmed by NPA last week.

The disclosure came as NPA announced that Franz T. Stone, president of the Columbus McKinnon Chain Corp, Tonawanda, N. Y., has been named assistant administrator of NPA. Stone who served on the World War II War Production Board, will supervise the work of the following new divisions: Electrical Equipment, Engine and Gas Turbine, General Components, Motor Vehicle, Railroad Equipment, Construction and Mining Machinery, Agricultural Machinery and Implements, and General Industrial Equipment.

Under the new plan, the present Power Equipment Division becomes the Engine and Turbine Division which will be headed by Charles F. Kells, PED director. Bonnell W. Clark will head the new Electrical Equipment Division.

Power equipment split between the two divisions will be made roughly at the generator busbar, with the Engine and Turbine Division handling generating equipment and with Electrical Equipment Division taking transmission equipment. PED, when it becomes ETD, will lose three sections to the new Electrical Equipment Division: Transformer, Switchgear, and Pole Line Hardware. It is expected that the present heads of these sections will be retained.

In addition to heavy power equipment, the divisions will both be responsible for many other items. Various tanks will fall under ETD as well as power boilers. EE will handle all electric motors including fractional horsepower.

Both divisions have been moved to new quarters in the new General Accounting Office Building, between 4th and 5th Sts and G and H Sts, NW.

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3 Officials of Depa Will Handle M-50 DO Ratings

Three Defense Electric Power Administration officials have been formally delegated authority to handle DO priority ratings under the terms of the National Production Authority's M-50 order.

Over-all responsibilities for Depa operations under M-50 have been delegated to William W. Brown, director of Depa's Materials and Equipment Division. Clinton T. Hurd, chief of the Materials and Equipment Requirements Branch of the Division, is authorized to use and order program materials for major plant additions. Harry I. Miller, chief of the Maintenance, Repair, and Operations Requirements Branch, will have authority to establish and make adjustments in MRO and minor plant requirements.

Depa's announcement said that the delegations were being made to simplify procedures for handling the distribution of program materials to utilities.

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Room, Phone Numbers of NPA's PED Changed

Several changes in room and phone numbers have been made since publication of the organization chart for the National Production Authority's Power Equipment Division (EW, March 26, p 88).

Here are some of the new assignments (rooms are in Building "T", 14th St and Constitution Ave, NW, Washington, 25, D. C.; Phone extensions are on Sterling 5200):

Condenser Section—Room 2016, X-3559.

Boiler Section — Room 1320, X-4888.

Coordination Section (A. B. Leonard, chief)—Room 2538, X-2572.

Diesel & Gas Engine Section—Room 1066, X-4811.

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Industry M Orders

The following M Orders of interest to the electrical industry have been issued by the National Production Authority. Orders not of interest have been omitted. Copies of orders may be secured from the National Production Authority, Washington 25, D. C., or any regional office of the Department of Commerce.

Amendments to Previous Orders

Amendment to M-1 requires users of **ferro-alloys** to submit monthly "melting schedules" for analysis by NPA. **Amendments to M-12 and M-50** allocate **copper** to electric utilities for maintenance and expansion of power plants and distribution and transmission lines.

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Battery Materials Scarce

Industrial storage battery makers have told NPA that they need help in getting raw materials.

Debt Money Will Cost Utilities More

Yields Have Risen Since Break in Price of Government Bonds; But Electric Companies Should Be Able to Market Securities

Electric utilities should have no great trouble raising debt money for their vast expansion programs in 1951 and 1952, but the cost will be higher. Bond yields have risen steadily since early in March when the Federal Reserve Board abandoned its policy of supporting Treasury bonds at par. They had maintained a fairly even level for the first two months of the year.

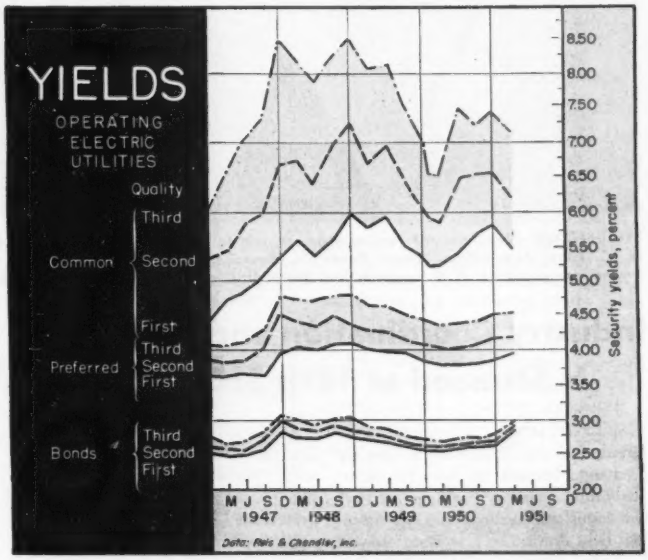
On March 29 the yield on first quality utility bonds reached 2.87%, the highest point since November, 1948. On March 1 the yield on these bonds was 2.70%. Second and third quality bond yields followed the same upward trend. Second quality yields were up from 2.72% on March 1 to 2.93% on March 29 and third quality from 2.80% to 3.00%.

Preferred and common stock yields also have increased but by a smaller percentage.

Cost of Floating Bonds Up

Since the break in the bond market there have been several tests indicating that utilities still would be able to float bonds successfully—but at an increased cost of about 0.5%. Consumers Power Co's offering of $40 million in bonds on March 28 was the first important utility company debt issue to reach the market after government bonds began to sell under par. The yield was 3.05% compared with the March 1 yield of 2.72% for bonds of a similar quality.

The following week Worcester County Electric Co and Potomac Edison Co offered bond issues. Worcester County drew four bids and Potomac Edison three. The yield for the Worcester issue was 3.17% and for Potomac Edison's 3.30%. The interest rates are highest for securities of similar quality since 1939. However investors showed keen interest in the issues indicating that utilities should be able to dispose of their offerings.



YIELDS on utility bonds started climbing in March after the Federal Reserve Board stopped supporting government bonds at par. Preferred stock yields went up slightly. Yields on common rose in March but are under December, 1950 levels

Preferred stock yields have risen steadily since March 1 but not quite to the extent that bond yields have. On March 1 first quality preferred stock yields were 3.81% and by the end of the first quarter they had reached 3.96%. Second quality preferred yields for the same dates were 4.01% and 4.19%, and for third 4.46% and 4.52%. There has been no indication of the level at which new issues can be marketed.

The outlook for common stocks is a little brighter. Common stock yields have been least affected by the break in the government bond market. The yield on first quality common rose only from 5.41% on March 1 to 5.47% on March 29. Second quality common yields increased from 6.09% to 6.20%. The increase in the third quality common yield was higher, from 6.81% to 7.13%, but other factors may have played a part.

The Dow-Jones average of utility stock prices was 3.1% higher at the end of the first quarter of 1951 than the average on Dec. 30, 1950. And common stock dividend increases were granted by six utilities in the first quarter. This compares with eight in the first quarter of 1950, but the drop is smaller than might be expected in view of higher taxes and rising costs.

New money financing by electric utilities during the first quarter totaled $382,872,000. This tops the 1950 first quarter total of $324,418,000 by 18%. The 1951 first quarter figure can be broken down as follows: $238,634,000 in bonds, representing 62% of total new financing for the quarter; $23,660,000 in preferred stock, 6% of the total, and $120,578,000 in common stock, 32% of the total.

Public Offerings

Electric Utility Securities

(Totals Estimated in Thousands of Dollars)

	FIRST QUARTER OF 1951		
	New Money	Other	Total
Bonds	$238,634	$9,866	$248,500
Preferred Stock	23,660		23,660
Common Stock	120,578		120,578
	$382,872	$9,866	$392,738

SEE OFFICERS elected for the coming year are, left to right, M. C. Funk, Appalachian Electric Power Co, Roanoke, Va., second vice president; H. C. Leonard, Gulf States Utilities Co, Beaumont, Texas, first vice president; Clifford B. McManus, The Southern Co, Atlanta, president; and L. C. McClurkin, Savannah Electric & Power Co, third vice president

Industry Coordination and Planning Is Stressed at 18th SEE Conference

Speakers at the 18th annual conference of the Southeastern Electric Exchange stressed the need for more generating capacity, selling activity, and industry coordination. The meeting, held April 11-13 at Boca Raton, Fla., was attended by more than 400 industry executives.

W. O. Turner, president of SEE and Louisiana Power & Light Co, opened the business session. Referring to efforts of several southeastern companies in forming Electric Energy, Inc, he said, "What is very important for this industry is a willingness to meet special situations, if necessary, through group effort."

Construction expenditures by southeastern companies for 1950, Turner said, were approximately $294 million, and estimated expenditures for 1951 stood at $320 million. For 1952 and 1953, he said, expenditures must of necessity be about the same as those of 1950 and 1951.

Today's tax burden, he said, is about as large as the industry can stand. "New taxes should be in such form as can immediately be passed on to and collected from the consumer."

A number of companies have already sought relief through increased rates, and any additional burden of taxes or operating expenses will necessitate further rate changes, he believes.

In discussing the threat of the government to the utility business, Turner said, "There seemingly is no end to this phase of the problem until the preference clause is eliminated or until there is a different interpretation of it by some other persons in office."

Phil H. Powers, president of West Penn Power Co, appealed for participation of all companies in EEI, ECAP, NAEC, and PIP. "There is no company in the industry so large or so small—so well-managed or so self-sufficient — that membership in these industry activities will not bring it many benefits. Their participation will add greater strength and solidarity to the whole industry," he said.

Responsibilities of utility management in selling activities were outlined by J. M. McKibbin, vice president, Westinghouse Electric Corp. He called on the utilities to cooperation with manufacturers in sales training work at the dealer level, to find ways to reduce buyer resistance developing from high installation costs, and to maintain a continuity of advertising and promotion effort to sell the idea of electrical living.

Chester H. Lang, vice president, General Electric Co, whose subject, "Here We Go Again," considered the new period of great expansion, called upon industry to "aim high, aim ahead, in spite of short-term dips and dives in the flight of history."

Lang outlined responsibilities of the industry. "First," he said, "we must

CONFERENCE SPEAKERS chat between sessions. Left panel, C. H. Lang, left, General Electric Co, with L. V. Sutton, EEI president. At right, J. M. McKibbin, Westinghouse Electric Corp, left, with P. H. Powers, West Penn Power Co

be ever ready to supply America with all the equipment and power she needs, whenever she needs it. Better than any other section of the country, you (southeastern executives) know there's only one good way to prevent unwarranted government interference —and that's to get there fustest with the mostest generators.

"Second is the need for continued sales pressure, and third, the responsibility to speak up for the way of freedom, truth, and common sense."

Sporn Makes Recommendations

Reading notes by Philip Sporn, president, American Gas & Electric Co, Harold Turner, vice president, Ohio Power Co, made these observations: Each system should reexamine its capacity expansion program to assure its adequacy. Transmission voltages should be restudied in the light of increased size of generating stations and load growth. Each utility management needs to examine its system layout, its facilities and its organization to find out for itself what would happen under conditions of emergency or catastrophe.

Alan H. Temple, vice president, National City Bank of New York, warned against excessive pessimism over inflation. He compared the trends to a roller coaster going up and down rather than to a continuing rise in prices.

Predicts Lower Yields

Thomas W. Goodle, vice president, Equitable Securities Corp, predicted bond yields would seek lower levels in the period ahead. He thinks the pendulum has overswung. Pointing out that insurance company holdings of preferred stock increased from $37 million in 1944 to $168 million in 1950, he suggested this was still a fertile field for new capital.

C. B. McManus, president of The Southern Co and Depa Administrator, was elected president of SEE for the year beginning July 1. He had indicated he will resign his government post on that date.

Besides McManus, the following officers were elected: First vice president, H. C. Leonard, Gulf States Utilities Co; second vice president, M. C. Funk, Appalachian Electric Power Co; and third vice president, L. C. McClurkin, Savannah Electric & Power Co.

DAVIS DAM power plant on Colorado 67 miles below Hoover Dam. Hatch covers for three 45,000-kw generators are shown at right. Giant crane operates on rails atop roof to install and maintain plant's equipment. Sandwich-like bus structures in foreground connect plant with transformers and conductors at the left

FPC Refuses to Hold Up Vepco Roanoke License

Federal Power Commission April 11 denied the motion of the Secretary of the Interior to stay issuance of a license to Virginia Electric & Power Co for development of the Roanoke Rapids site.

FPC, in effect, said the license had already been issued. Its new order said its decision of Jan. 26 issued a license to Vepco. Acceptance of the license was filed with FPC by Vepco on Feb. 1, nearly two months before the motion to stay was filed.

"Consequently," the commission concluded, "there is nothing pending before the commission at this time which it could stay and the motion must be denied."

The secretary has indicated the FPC decision will be challenged in the Fourth Circuit Court of Appeals in Richmond, Va., by April 30. (EW, April 16, p 19.)

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Cleveland Utility Grants 6½¢ Raise to CIO Local

Cleveland Electric Illuminating Co and Local 270, Utility Workers Union of America, CIO, have signed a new contract calling for a 6½¢, across-the-board raise for 2,800 employees represented by the union.

The contract includes a wage reopener clause for one year from the agreement, an improved military leave clause, and other changes, a union spokesman said.

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING FEBRUARY

Utility	Plant	Fuel	Capacity (Kw)
Cambridge (Mass.) Electric Light Co	Kendall Square	S	20,000
Rochester (N. Y.) Gas & Electric Corp	Rochester Station	S	50,000
Metropolitan Edison Co	Titus, Pa.	S	75,000
Troy (Ohio) Light & Power Co	Troy	S	5,000
McCleansboro (Ill.) Light & Power Plant	McCleansboro	IC	645
Dairyland Power Cooperative	Stoneman, Wis.	S	17,250
Carrollton (Mo.) Municipal Utilities	Carrollton	IC	900
Virginia Electric & Power Co	Reeves Ave.	S	40,000
Tennessee Valley Authority	Ocoee	H	10,500
Tennessee Valley Authority	South Holston	H	35,000
U. S. Army Engineers	Narrows, Ark.	H	8,500
Community Public Service Co	Higgins, Tex.	IC	100
Dallas (Tex.) Power & Light Co	Dallas	S	60,000

PLANT RETIREMENTS DURING FEBRUARY

Cambridge (Mass.) Electric Light Co	Cambridge	S	1,500
Florida Power Corp	Apalachicola	IC	300
Community Public Service Co	Spearman, Tex.	IC	100
Central Arizona Light & Power Co	Gila Bend	IC	293

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of March 1—Steam, 49,652,650 kw; Internal Combustion, 1,916,287 kw; Hydro, 17,851,806 kw; Total, 69,420,743 kw.

F. F. NORTHROP, president, Northwest Public Power Association, shows program of annual convention in Wenatchee, Wash., to C. T. Hurd, left, chief of Depa's Materials and Equipment Requirements Branch, and John Nelson, Seattle City Light

Peaking Deficiency of 250,000 Kw Forecast by Erdahl at NPPA Confab

Peaking deficiency of 250,000 kw in the western group of the Northwest Power Pool will result from median water conditions next winter —with defense loads yet to come. C. A. Erdahl, Commissioner of Tacoma City Light and chairman of the Pacific Utilities Conference Committee, reported this latest figure to the annual convention of the Northwest Public Power Association in Wenatchee, Wash, April 12-14.

He urged unity of thought and action among all power interests in the region to convince defense authorities of the critical need for immediate approval of the 1 million kw of nonfederal capacity which local utilities can supply in the next two to three years. He also urged all-out support of the long-range federal program in the area but reserved endorsement of the proposed Oregon-California intertie and federal steam plants. These reservations he justified on the basis that local hydro developments were better and would produce power for a longer period at far less cost.

Clinton T. Hurd, chief of the Materials and Equipment Requirements Branch of Depa, assured the group that the seriousness of the Northwest power situation was recognized in Washington. He said efforts were being made to get blanket priority for the proposed power projects to enable free certification of required materials and equipment. He also described the aluminum and copper situation as tight and said that although some relief is in sight in aluminum by the end of the year, copper is not susceptible to increased production and will get much tighter.

Positive action to assure maintenance of present schedules on major and minor items of equipment for installations now under construction was recommended by John Nelson, Seattle City Light. He pointed out that provisions for freezing manufacturers' order boards have not yet been applied in the case of large hydro turbines or generators. Projects now underway, such as Seattle's Skagit project, can be completed on schedule only if some provision is made to maintain equipment schedules now subject to displacement by priority orders, he said.

F. Ford Northrop, Eugene Water Board, warned in his report as association president there is potential danger in the "calculated risk" taken by the Secretary of the Interior in assigning additional heavy industrial defense loads to the Northwest on the basis of median water for a period of several years.

"Let us insist," he said, "that we have a part in planning for increased generation and loads, that Depa and the Department of the Interior confer with us before commitments are made. Water resources belong to the region and the region has a right to participate in discussions for their use."

•

Uleman Jailed in Attempt to Buy Legislators' Votes

Attempted bribery of two Washington state legislators in connection with the controversial Spokane power bill has resulted in a 120-day jail sentence for John Uleman, free-lance lobbyist. (EW, March 19, p 6)

Uleman testified that a man he identified as a pinball lobbyist had influenced him to seek the legislators' votes. He added that should this man fail to show up with the bribe money when needed, he was told to see a Leo McGavick.

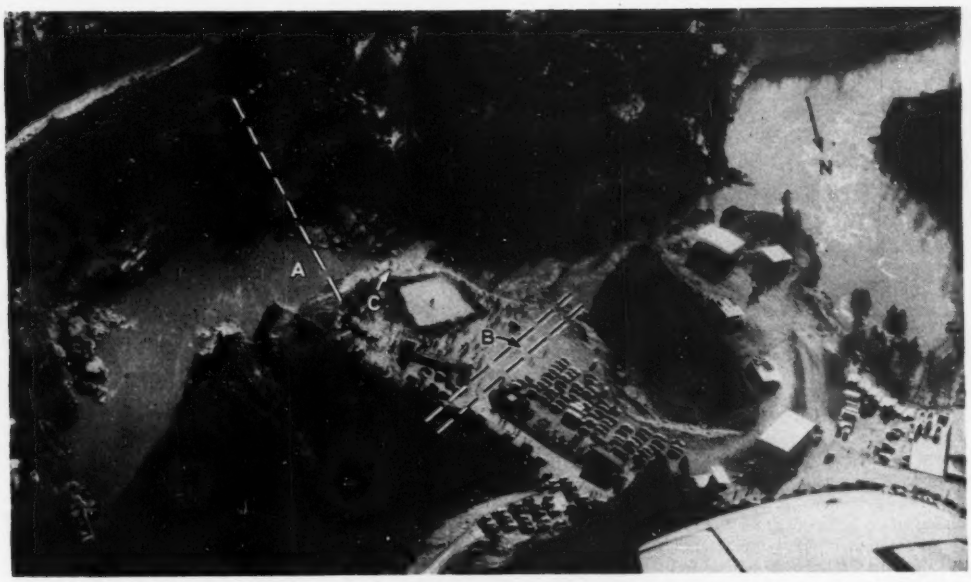
A special legislative committee appointed to investigate the bribe case referred in its majority report to Leo McGavick, Tacoma attorney, as being "widely known as a representative of private power interests" backing the Spokane power bill.

•

New Line Specifications Are Approved by REA

New standard specifications to provide heavier lines have been approved by the Rural Electrification Administration because farmers were using more power than was expected when the old standard specifications were adopted.

New specifications call for voltages double those of present standard lines. They are in addition to, and do not supplant, standards now in use. Former voltages will continue to be used in many cases, REA said. To meet conditions of heavily loaded lines and long distances required for distribution in some areas, REA has adopted 14.4 kv as a standard single-phase distribution voltage in addition to the standard 7.2 kv.



CABINET GORGE project of Washington Water Power Co in Idaho is begun at ceremony in which helicopter, in square, brings message from Montana's Governor Bonner. Navy photo shows where dam and four 50,000-kw generators will be installed. "A" is approximate axial line of dam, "B" the line of diversion tunnels, and "C" the power house area. Power is slated to flow in September, 1952. Site is on Clark Fork River ten miles above Lake Pend Oreille and town of Clark Fork

1.5 Million Kw of Northwest Power Needed to Meet Defense Demands

Defense production will require 1.5 million kw of Northwest power by 1955 and possibly 3.7 million kw by the end of 1959, a report by Samuel Moment, Bonneville Power Administration economist, disclosed recently.

The economist said the entire defense production picture will be changed for the area unless the government's dam construction program goes ahead on schedule.

By 1960, Moment said, the Northwest should expect to supply at least 1.6 million kw for aluminum production alone, turning out 800,000 tons, approximately 45% of the nation's total. Titanium production will require 900,000 kw.

Because of relatively small payrolls involved in production of aluminum ingots, considerable opposition has developed in Northwest business circles to proposed power allocation to the light metal industry.

In a report last year, BPA estimated the light metal requirements for energy would be about 18% of the total load in 1959, compared with 23% in 1950. The 18% figure hinged on expanded electrical output, diversification of industry, and increased domestic use.

If the defense program, as outlined by the economist, is carried out it will mean a thorough revision of Bonneville's program for power distribution. Before the Korean war no power had been alloted to aluminum expansion until after 1959.

•

Gets Commission Post

Jerome K. Kuykendall has been appointed to the Public Service Commission in the State of Washington. He fills the vacancy created by the resignation of Raymond W. Clifford, who has been appointed Judge of Thurston County Superior Court.

State Protests Extension of Franchise by Oakland

Pacific Gas & Electric Co has concluded an agreement for a new 50-year electric franchise with the City of Oakland, but the contract concedes the State of California's right to challenge the legality of the arrangement.

The state had protested the new franchise in an attempt to force the utility to pay for relocations of its facilities made necessary by state freeway construction (EW, Nov. 20, 1950, p 99). Under state law, the state must pay for utility relocation if a utility's facilities are lawfully maintained in a location not a state highway at the time of their installation and if its franchise does not specifically require that it pay such costs.

PG&E has borne about $83,000 in relocation costs and has billed the state for that amount. C. H. Purcell, state director of public works, had written Oakland City Council that about $2.5 million would be "saddled" on the state if the franchise were approved and intimated he would oppose future allocations unless the city paid the relocation costs.

YIELDS (%) — Operating Electric Utility Securities

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1951									
Apr. 11	2.87	2.94	3.03	4.00	4.23	4.52	5.31	6.26	7.05
Apr. 5	2.88	2.94	3.03	3.96	4.22	4.52	5.50	6.22	7.09
END OF QTR.									
4th 1950	2.65	2.67	2.78	3.86	4.14	4.51	5.80	6.54	7.44
3rd 1950	2.66	2.67	2.76	3.81	4.08	4.46	5.70	6.54	7.25
2nd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67

Data: Reis & Chandler, Inc.

PUD Offers Port Angeles Lower Rate Agreement

The Clallam County PUD has offered the City of Port Angeles, Wash., a new power contract which includes a lower rate structure and refunds $80,000 to the city in settlement of claims of each party against the other for the period prior to Jan. 1, 1951.

When the PUD began buying from Bonneville Power Administration, after perviously buying from Puget Sound Power & Light Co, it received a rate reduction of abount 1 mill from its previous 4.6-mill rate. The PUD in turn, six months later, took a mill off the rate it charged Port Angeles for re-sale within the city.

Since the city had been paying the PUD approximately 8 mills, city officials contended that, percentage-wise, this reduction actually increased the PUD profit on re-sold power. James W. Carey and H. W. Kramer, Seattle consulting engineers, recommended last year against the city's continuing the contract.

The new contract, for 19 years, would be retroactive to Jan. 1, replacing a contract which would run to 1956. It provides that the PUD re-sell power to the city at 1.5 mills per kwhr over the price paid by the PUD to Bonneville until 1957, at 1 mill over the Bonneville price after 1957. The city would pay 0.25 mill per kwhr for power exceeding the 1950 amount.

The PUD proposals require the city to install power factor corrective equipment to bring its power factor to 95% or better or pay power factor penalties based upon the BPA formula, to install reactive metering equipment in its 66-kv substations, and to control peaks as far as possible to prevent operation of the BPA ratchet clause.

A similar proposal, without the $80,000 refund, was rejected by the city last year.

•

McDonald Reappointed SEC Head for 5 Years

Harry A. McDonald has been reappointed chairman of the Securities and Exchange Commission by President Truman and confirmed by the Senate for a new five-year term on SEC ending June 5, 1956.

A former Detroit dairyman and investment banker, McDonald was appointed to SEC in March, 1947, succeeding the late Robert E. Healty. He became the first Republican to serve as SEC chairman on Nov. 4, 1949.

•

Sale of Dunkirk System to Niagara Mohawk Out

Voters in Dunkirk, N. Y., do not want their municipally owned distribution system sold to a private company, nor do they want it renovated. They voted against sale of the system to Niagara Mohawk Corp for $514,000 and also rejected a proposal to issue $400,000 in bonds to improve the system.

The city has not manufactured its own power for many years, but has purchased it from Niagara Mohawk for distribution through its own system. The utility company had promised to spend $400,000 on renovation immediately, if allowed to buy the system, and $1 million more within ten years.

•

Florida P&L Plans to Sell Properties in 3 Towns

Plans for the sale of the Monticello, Perry, and Madison properties of Florida Power & Light Co to Florida Power Corp have been drawn up and will be presented to the Federal Power Commission soon for approval.

Sale of these properties to Florida Power Corp will eliminate the only section of Florida Power & Light's system not tied into the interconnected system. The three communities are almost surrounded by areas served by main transmission lines of Florida Power.

FINANCIAL BRIEFS

Public Service Electric & Gas Co, Newark, N. J., has agreed to cut its electric rates by $5 million a year in compliance with an order by the Public Utilities Commission. The commission issued its order after an investigation of electric rates last November. The company's proposal to reduce rates by $3 million was rejected by the PUC.

Refunds to Columbus electric consumers estimated to total more than a million dollars have been ordered by the Ohio Public Utilities Commission. The order was based on an agreement between the city and Columbus & Southern Ohio Electric Co (EW, Sept. 25, 1950, p 85).

Electric Utility Financing—April 7-14

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Common Stock				
Mountain States Power	150,000 sh new money	$1,650	$11.00	7.64

SCHEDULED FOR FOLLOWING WEEK

Bonds—Wisconsin Power & Light, 1st mtg "E", 1981 new money, $4 million; Duke Power, 1st and ref mtg, 1981 new money, $35 million; Mountain States Power, 1st mtg, 1981 new money, $2 million.

Common Stock—Columbus & Southern Ohio Electric, 200,000 sh new money, $4 million; Montana-Dakota Utilities, 236,755 sh new money, $3.5 million.

Niagara Mohawk Gets Dam Project License

The Federal Power Commission has ordered issuance of a 50-year license to Niagara Mohawk Power Corp for construction and operation of a dam and storage reservoir on the Raquette River in St. Lawrence County, N. Y.

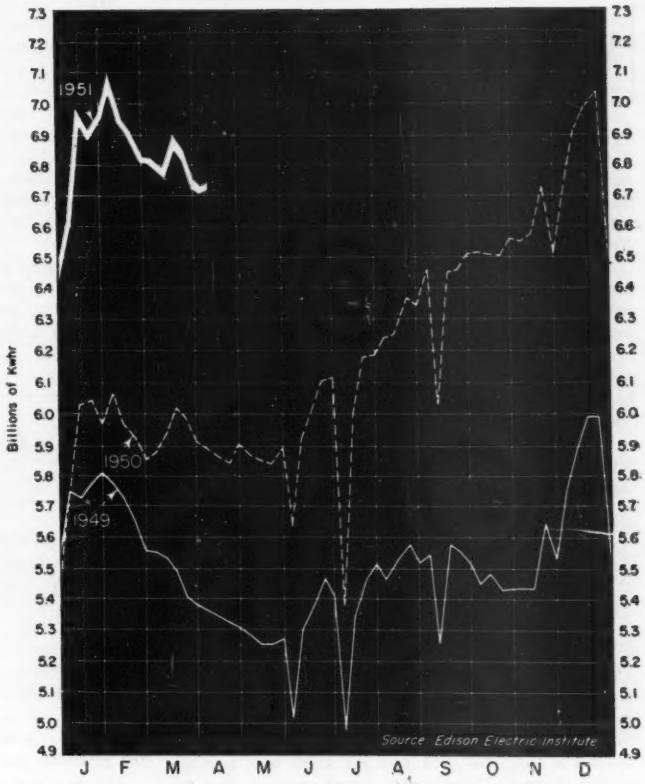
The project, designated the Carry Falls development, will include a concrete dam approximately 830 ft long and 70 ft high; regulating gates; an intake for a future power installation; and five earth dikes creating a reservoir extending about five miles upstream. The reservoir will be used to regulate stream flow at Niagara Mohawk's hydro developments on the lower reaches of the river, thereby increasing the output of those plants.

The company does not plan at present to construct a power development at the Carry Falls site. However, provision is being made for a future installation.

•

Veale to Fill White Term

John M. Veale has been appointed to fill the unexpired Michigan Public Service Commission term of Stuart B. White, recently killed in an automobile accident (EW, Dec. 4, p 155). The term expires July 2, 1953. Charles M. A. Martin was designated chief counsel for the commission, succeeding Archie C. Fraser.



Output Week Ended April 14—6,746,975,000 Kwhr

Weekly Output, Millions Kwhr

1951		1950		1949	
Apr 14	6,747	Apr 13	5,863	Apr 12	5,343
Apr 7	6,736	Apr 8	5,898	Apr 9	5,360
Mar 31	6,767	Apr 1	5,912	Apr 2	5,378
Mar 24	6,848	Mar 25	5,993	Mar 26	5,404
Mar 17	6,903	Mar 18	6,015	Mar 19	5,496
Mar 10	6,795	Mar 11	5,937	Mar 12	5,531
Mar 3	6,822	Mar 4	5,879	Mar 5	5,552
Feb 24	6,833	Feb 25	5,854	Feb 26	5,559
Feb 17	6,905	Feb 18	5,931	Feb 19	5,650
Feb 10	6,957	Feb 11	5,971	Feb 12	5,722

Percent Change from Previous Year

	Apr 14	Apr 7	Mar 31
New England	+12.3	+13.6	+12.8
Mid-Atlantic	+13.1	+13.3	+10.8
Central Industrial	+14.7	+14.7	+14.5
West Central	+14.9	+11.7	+13.4
Southeast	+16.0	+13.6	+15.8
South Central	+19.5	+19.0	+19.7
Rocky Mountain	+ 6.4	+ 6.8	+ 9.7
Pacific Coast	+18.9	+17.7	+18.0
Total United States	+15.1	+14.2	+14.5

MEETINGS

Northwest Electric Light & Power Association
Engineering Section, Hotel Utah, Salt Lake City, Utah, April 25-27; Business Development Section, Multnomah Hotel, Portland, Ore., May 7-9; Personnel Section, Davenport Hotel, Spokane, Wash., May 16-18.

Edison Electric Institute
Purchasing and Stores Committee Annual Conference, Lord Baltimore Hotel, Baltimore, Md., April 30-May 2; Transmission and Distribution Committee, Edgewater Beach Hotel, Chicago, May 1-2; Hydraulic Power Committee, Tapoco Lodge, N. C., May 3-4; Meter and Service Committee, jointly with Association of Edison Illuminating Companies' Committee on Metering and Service Methods, Huntington Hotel, Pasadena, Calif., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 9; EEI Accident Prevention Committee, Hotel Utah, Salt Lake City, Utah, May 21-22; Electrical Equipment Committee, Hotel Biltmore, Los Angeles, Calif., May 28-29; Annual Convention, Shirley Savoy Hotel, Cosmopolitan Hotel, Denver, Colo., June 4-7.

American Institute of Electrical Engineers
District No. 1 Meeting, Hotel Syracuse, Syracuse, N. Y., May 2-4; District No. 5 Meeting, Loraine Hotel, Madison, Wis., May 17-19; Summer General Meeting, Royal York Hotel, Toronto, Canada, June 25-29.

★**Pennsylvania Electric Association**
Communications Committee, Bedford Springs Hotel, Bedford, Pa., May 3-4; Joint Meeting of Electrical Equipment, Transmission and Distribution Committees, Abraham Lincoln Hotel, Reading, Pa., May 10-11; Relay Committee, Hotel Jermyn, Scranton, Pa., May 17-18; Prime Movers Committee, Penn-Belle Hotel, Bellefonte, Pa., May 24-25; Meter Committee, Irem Temple Country Club, Dallas, Pa., May 24-25.

New Jersey Utilities Association
Spring Meeting, Seaview Country Club, Absecon, N. J., May 4.

American Public Power Association
Annual Convention, Read House, Chattanooga, Tenn., May 7-9.

New York Society of Professional Engineers
Engineering Industries Exposition, Hotel Statler, New York, May 10-12.

Missouri Valley Electric Association
Accounting Conference, President Hotel, Kansas City, Mo., May 17-18.

Public Utilities Advertising Association
Annual Meeting, Hotel New Yorker, New York, May 17-19.

Protective Relay Engineers
Annual Conference, Georgia Institute of Technology, Atlanta, Ga., May 18-19.

★**National Association of Electrical Distributors**
Annual Convention, Chelsea Hotel, Atlantic City, N. J., May 20-25.

Missouri Association of Public Utilities
Annual Convention, Jefferson Hotel, St. Louis, Mo., May 21-23.

Pacific Coast Electrical Association
Annual Convention, Biltmore Hotel, Los Angeles, Calif., May 21-23.

American Society of Mechanical Engineers
Semi-Annual Meeting, Royal York Hotel, Toronto, Canada, June 11-15.

Canadian Electrical Association
Annual Convention, Algonquin Hotel, St. Andrews, New Brunswick, June 18-21.

American Society for Testing Materials
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 18-22.

★ Addition this week

WASHINGTON COMMENT

RONALD D. ROSS

There was some premature rejoicing the other day when it was announced that the Bureau of Reclamation had signed a contract with Pacific Gas & Electric Co. At first glance, it looked like peace in the bitter battle between federal and private power in California's Central Valley. And private power had won.

The plain fact is that the contract did not end the fundamental and bitter disagreement between the company and the Interior agency. Major aspects of the fight were not even touched by the contract.

As far as it goes the new pact is a victory for private power. Some of the extensive transmission network which Reclamation planned for the valley will not be necessary. Funds for several lines probably will not be appropriated by Congress. If they are, Reclamation will not build the lines. The contract is another boost for the idea that duplicating transmission lines are not a necessary adjunct of federal hydroelectric projects, even to serve preference customers.

PG&E Contract Similar to Others

Described by Interior as a "wheeling service" contract, the new agreement is similar to other Reclamation-company contracts in the Missouri Basin and the famous "Oklahoma Contract" between private electric utilities and Interior's Southwestern Power Administration. Energy from federal projects will be purchased by the company. Federal preference customers will be served over company lines for a basic fee of 1 mill per kwhr plus monthly demand charges. There are important provisions for the company's operations, too. Federal customers are to be served only when capacity is available in excess of company requirements. Preference customer deliveries will be made only outside the boundaries of municipalities served by the company.

Major difference between the new PG&E contract and many other Reclamation contracts is that it is to be in effect for only ten years, while other contracts are for 15 or 20 years. This could mean the contract is an interim measure as far as Reclamation is concerned. In the months and years ahead, mobilization demands will make it increasingly difficult to get both funds and materials for controversial construction. Reclamation is not scrapping any plans for transmission facilities. It is merely putting some of them on the shelf until a more favorable time, say ten years from now, when they could be trotted out again.

Fate of Kings River Still Undecided

The contract does not resolve the transmission dispute between PG&E and Reclamation, but even if it did, power peace would not reign in Central Valley. Today's big prize in the valley is Kings River. Interior power planners want to add it to the Central Valley program. They have plans, including the purchase of an existing PG&E plant, for an extensive new federal power expansion on the river.

PG&E, too, plans to expand its hydroelectric installations on the Kings. In November, 1949, the Federal Power Commission approved the company's plans, but Interior protested. At a rehearing more than a year ago, Secretary Chapman personally argued that the Kings was a part of his Central Valley empire. The commission has not yet affirmed or reversed its decision. Meanwhile, Interior is taking a similar case, Roanoke Rapids, to the courts this month. Interior officials privately admit that part of the department's zeal in the Roanoke Rapids scrap is a feeling that it might be a precedent for the ultimate dicision on Kings River.

Encouraging as the new contract is, it is only one small step toward ending the Central Valley power fight. Another step, long overdue, is a decision from the Federal Power Commission on PG&E's license applications on the Kings.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Inspection of underground system revealed four instances of defective conditions for each 30 inspections, and one of the four would probably have resulted in an early failure.

Magnetic alloys which are improved by rapid cooling are generally benefitted if the cooling is done in a magnetic field below the Curie point.

Compression joint tolerances should not be too skimpy nor too generous; one means trouble for the splicer, the other a joint with possible voids.

Loads of 3,000 kw have popped up almost over night at unexpected suburban shopping centers.

Nuclear power reactors of the breeding type will have to operate at temperatures slightly above those customary for superheated steam in order to derive comparable thermal efficiencies. The heat transfer engineer will be as indispensable in the design as the nuclear physicist.

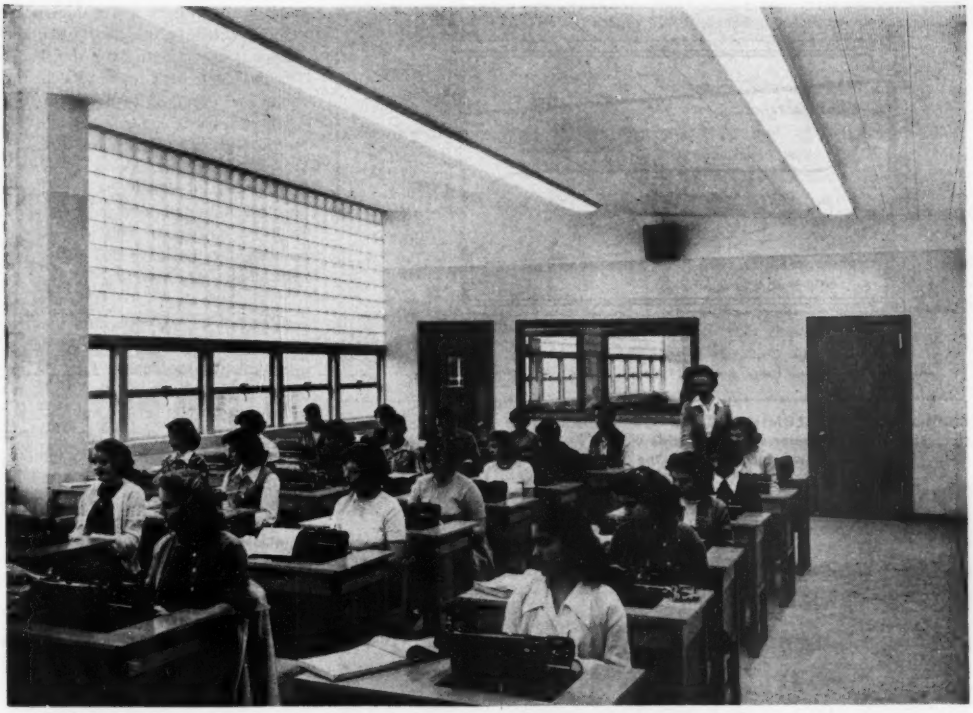
Inhibiting of oil against oxidation lacks as yet the positiveness that would warrant omission of the built-in protections like tank sealing, conservators, etc.

High-speed recording instruments arranged for automatic switching have been helpful in ascertaining the causes of system disturbances.

Resistance measurement has its usefulness for the farmer who wants to know when drying-out soil needs irrigation.

Anti-freeze injected into the tumblers of outdoor switches prevents freezing, and no harm is found to result.

Energy losses in suspension clamps even with steel U-bolts have been found to comprise less than ½ % as much as those in the conductors.



UNIFORM LIGHTING without glare is provided by continuous rows of fluorescent lamps plus glass block walls in the W. B. Ray High school, Corpus Christi, Texas. Artificial lighting supplements any variation in intensity of daylight

These School Children Study Under Uniform Daytime Illumination

Daylight and artificial illumination are coordinated to give 150 ft-c to all of classroom area. Glare, high brightness and strong shadows sometimes associated with too much daylight have been eliminated by glass blocks

A. T. MOSES, Consulting Engineer
Darley and Moses, Austin, Tex.

Coordination of daylighting and artificial lighting has been accomplished in the new W. B. Ray School of Corpus Christi, Texas. The result is 150 ft-c of good lighting over the entire classroom area during the day, when rooms are in use. This installation has overcome the objectionable features of high brightness, strong shadows and glare that so frequently accompany efforts to admit as much daylight as possible. Also overcome are the objectionable features of lighting designed for uniformity of night lighting but which usually results in non-uniform illumination when daylight enters.

In the design of the Ray School, the aim was to achieve as much daylighting as practicable, with its objectionable features screened out, and its deficiencies filled in with artificial illumination. At Ray School artificial lighting was designed primarily to supplement daylighting. All classrooms, laboratories, and study halls were lighted by two continuous rows of recessed three-lamp lens-bottom fluorescent units spaced asymmetrically; one row is near the center line of the room, the other near the inside wall.

This spacing was carefully worked

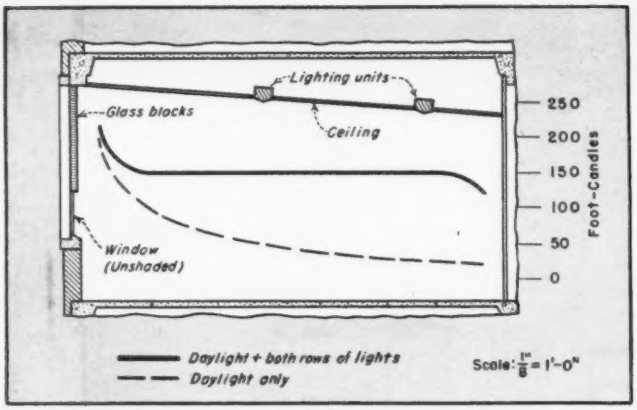


FIG 1—DAYTIME ILLUMINATION of 150 ft-c is provided uniformly by rows of fluorescent units at center and near inside wall and with glass blocks in the outside wall. Curves are for a typical room on the shady side of the school

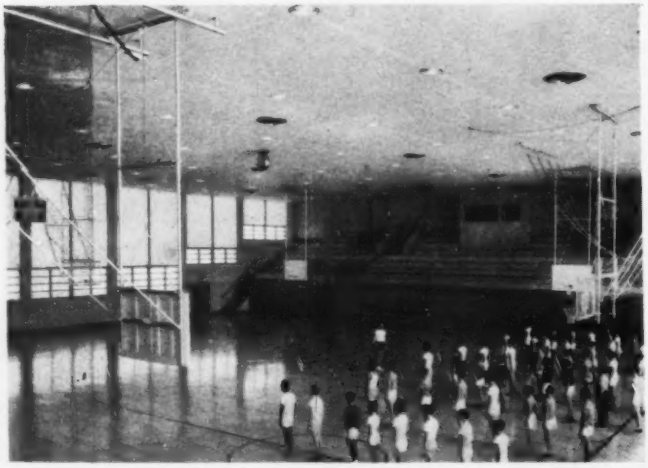


FIG 2—GYMNASIUM LIGHTING is with 1,000-w filament lamps spaced symmetrically 14½ ft on centers in an acoustical board ceiling 28 ft above the playing floor. Uniform illumination of 36 ft-c is provided on the playing floor

out after a study of the distribution of daylight in classrooms having outside walls made up principally of directional glass block. The switching arrangement of the lighting units is such that on a bright cloudy day the inside row may be turned on, and on a dull cloudy day both rows may be turned on, thereby achieving a fairly uniform illumination throughout the room under any conditions. The choice of two rows of three-lamp units, rather than three rows of two-lamp units, was for the sake of economy, which is always a necessary consideration in school plant design.

No Night Classes . . . For night classes the lighting would not be very uniform, but this fact is extenuated by several considerations: (1) It is not anticipated that this building will be used for night classes at any time, because the school system has adequate facilities in other schools where night classes are now held; (2) night classes are usually of a nature requiring somewhat less visual effort than regular day school classes; (3) most night classes are small enough to be seated in the inside two-thirds of the room where lighting is adequate.

Curves shown in Fig 1 indicate the total incident light on a horizontal plane 2 ft above the floor when the outside wall was entirely in the shade. The incident light just outside the room was observed to be 2,000 ft-c.

The library is lighted with a symmetrical pattern of the same units as those used in classrooms. Lighting fixtures are designed to provide a uniform illumination of approximately 55 ft-c, maintained. This wing of the building does not have the daylighting that other parts have.

Gymnasium . . . Gymnasium lighting is by means of recessed high-bay reflectors with 1-kw filament lamps. The units are spaced symmetrically 14 ft, 6 in. on centers each way, in an acoustical board ceiling 28 ft above the playing floor (Fig 2). An aluminum concentric ring louver is installed in the ceiling immediately under each unit for directional control and mechanical protection. Each unit is mounted in a hinged frame and connected by means of a few feet of flexible cord to a heavy duty receptacle in the attic space. Cat-walks are provided in the attic for re-lamping and servicing the lighting units.

Switching of these units is such that a rather wide selection of lighting arrangements is possible. Lights near the outside walls may be turned off, leaving on all or alternate lights nearer the center of the playing floor. A very uniform illumination of approximately 36 ft-c, maintained, will be available for competitive athletic events.

FIG 3—CORRIDORS and stairways are lighted to an average of 10 ft-c

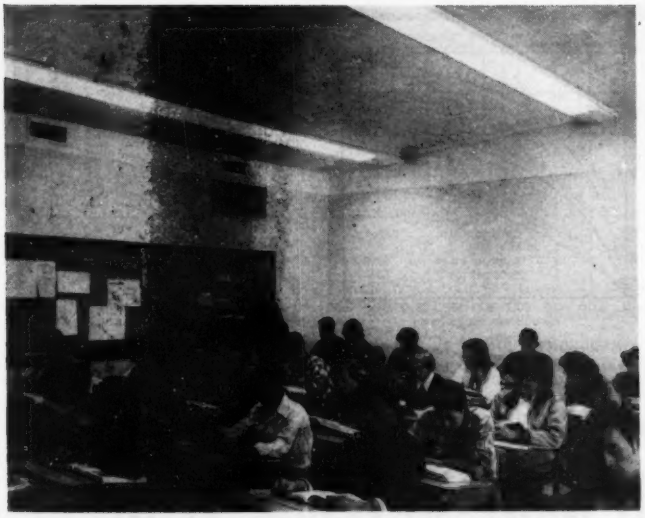


FIG 4—INSIDE WALL of classroom is illuminated by daylight admitted through glass blocks in outside wall. On cloudy days, one or both rows of fluorescent units are turned on to maintain uniform illumination in the classroom

FIG 5—LABORATORY of the Ray School is illuminated uniformly in the same manner as are classrooms. If night classes become necessary, fluorescent luminaires will provide adequate light for the inside two-thirds of classrooms

Cafeteria and Corridors . . . In the cafeteria, general illumination is provided by means of the same type fixtures as those used in the class rooms. Since it is anticipated that this space will be used for social events, units are placed for uniform illumination at night of about 20 ft-c but with some selection available.

All corridors, Fig 3, and stairways are lighted to an average of 10 ft-c with the recessed fluorescent fixtures installed as individual units. Figure 4 shows how the fluorescent units are used on cloudy days to provide uniform illumination in a typical classroom. The same kind of control is used in the laboratory (Fig 5).

Selecting Units . . . For selecting the recessed fluorescent units, which comprised the bulk of the fixtures used, manufacturers were required to submit samples for examination and testing under simulated service conditions. All of the samples submitted were installed in an accoustical ceiling and subjected to a series of tests. Each unit was checked for ease of relamping, ease of replacement of starters and ballasts, operating temperatures in the troffer, appearance, apparent brightness, and light distribution.

Flexibility . . . Since the building generally is of modular design, with a module of 4 ft, the lighting was designed on the same basis. Over long runs of classrooms the lighting troffers are continuous, and in 4-ft sections centered on window mullions. At each partition between classrooms the troffers are left empty and provided with metal covers in lieu of the lens bottoms. In the event, then, of any future shifting of partitions it will only be necessary to remove the ballast, sockets and other equipment from one 4-ft section of troffer to another, and to do a minor amount of rewiring.

Lighting Sales in 1950 For the Average Utility

Number of lighting layouts made by the average electric utility in 1950 was 841. This non-existent utility has 17.8 people who sell lighting. Of the lighting installations in new buildings in its service area the specialists of this utility designed 46.3%, and 48.3% of the jobs in existing building. Requests for recommendations on makes of fixtures to purchase are made in 56% of the new lighting jobs.

These figures come from an "Electrical World" survey of lighting sales methods. They are based on replies from 48 utilities whose combined capacity and number of customers represent about one third of the total.

Of the respondent utilities, 43.7% specify only general types of fixtures in lighting layouts, 54.3% designate fixtures by brand names. Independent of layouts, 45.7% of them recommend fixtures of specific makes.

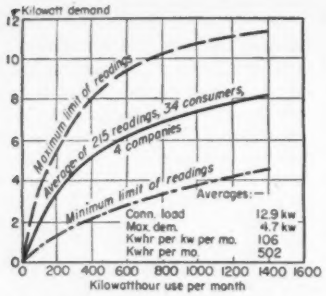

Kilowatt demand
Maximum limit of readings
Average of 215 readings, 34 consumers, 4 companies
Minimum limit of readings
Averages:—
Conn. load 12.9 kw
Max. dem. 4.7 kw
Kwhr per kw per mo. 106
Kwhr per mo. 502
Kilowatthour use per month

FIG 1—RESIDENTIAL customer data show kw demand vs kwhr per mo. for 34 consumers, 3 having no large appliances; 4, water heaters; 25, ranges

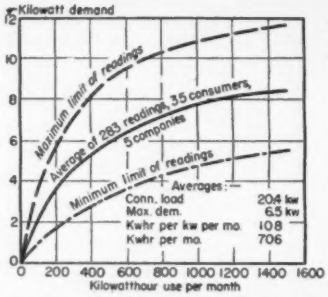

Kilowatt demand
Maximum limit of readings
Average of 283 readings, 35 consumers, 5 companies
Minimum limit of readings
Averages:—
Conn. load 20.4 kw
Max. dem. 6.5 kw
Kwhr per kw per mo. 108
Kwhr per mo. 706
Kilowatthour use per month

FIG 2—DATA SHOW kw demand vs kwhr per month for 35 residential consumers, each with range and water heater. Kwhr per kw about same as Fig 1

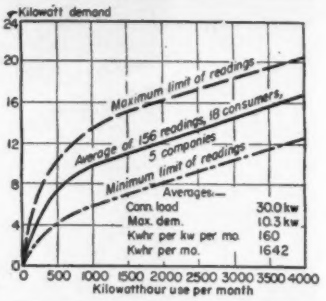

Kilowatt demand
Maximum limit of readings
Average of 156 readings, 18 consumers, 5 companies
Minimum limit of readings
Averages:—
Conn. load 30.0 kw
Max. dem. 10.3 kw
Kwhr per kw per mo. 160
Kwhr per mo. 1642
Kilowatthour use per month

FIG 3—CUSTOMER data show kw demand vs kwhr use per mo. is higher for 18 residences having range, water heater, large space heating load

How Much More Revenue With High-Demand Loads?

GEORGE E. SANGSTER, Sales Research Manager
Sangamo Electric Co, Springfield, Ill.

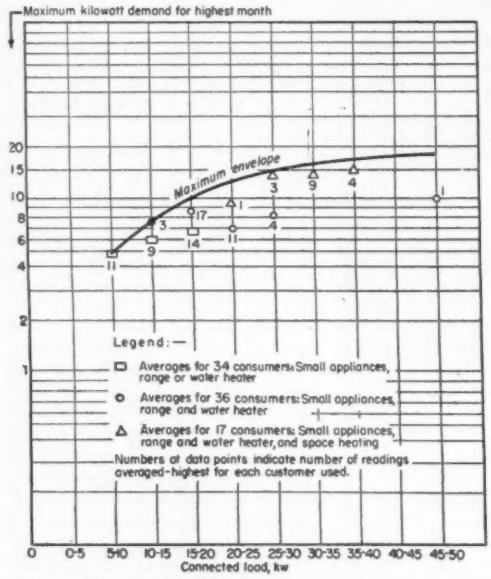

Maximum kilowatt demand for highest month
Maximum envelope
Legend:—
Averages for 34 consumers: Small appliances, range or water heater
Averages for 36 consumers: Small appliances, range and water heater
Averages for 17 consumers: Small appliances, range and water heater, and space heating
Numbers at data points indicate number of readings averaged-highest for each customer used.
Connected load, kw

FIG 6—DEMAND GROWTH RATE of residential customer as connected load increases is shown by test data

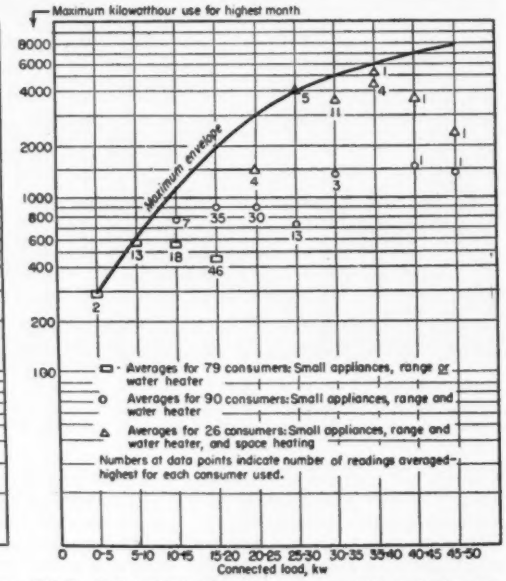

Maximum kilowatthour use for highest month
Maximum envelope
Averages for 79 consumers: Small appliances, range or water heater
Averages for 90 consumers: Small appliances, range and water heater
Averages for 26 consumers: Small appliances, range and water heater, and space heating
Numbers at data points indicate number of readings averaged-highest for each consumer used.
Connected load, kw

FIG 7—TEST DATA also show rate at which kwhr for residential customer increases with increases in connected load

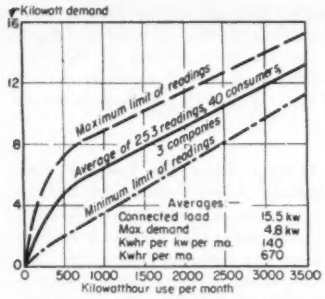


FIG 4—FARM customer data show kw demand vs kwhr use per month for 40 residences on rural lines having a wide variety of appliances

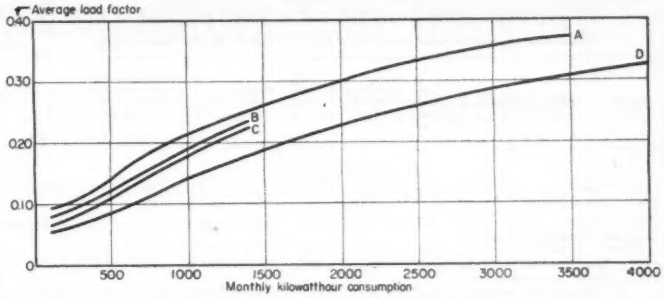


FIG 5—LOAD FACTORS of residential and rural customers increase with kwhr use. Curve A is for 40 rural customers represented in Fig 4. Curve B is for 34 residential customers represented in Fig 1; curve C is for 35 customers represented in Fig 2; and curve D is for 18 customers represented in Fig 3

Survey with special register shows relationship of demands to kwhr use, load factors, and the number of kwhr used at the higher demands

Growing loads of residential and rural customers have raised questions about their demands and the cost of serving them. Naturally this has raised questions about the feasibility of rates that take into consideration the demands and related costs of serving such loads.

In view of this, a request was made for a meter that would give some measure of demand in a device that would be lower in cost than the standard demand meter. The result was a special watthour meter register. Although this does not measure true demand it does register the number of kwhr used at demands in excess of a predetermined kw value which is set on the meter at the factory. Such measurement makes it possible to fix a special, or premium rate, for those kwhr used at the higher demands.

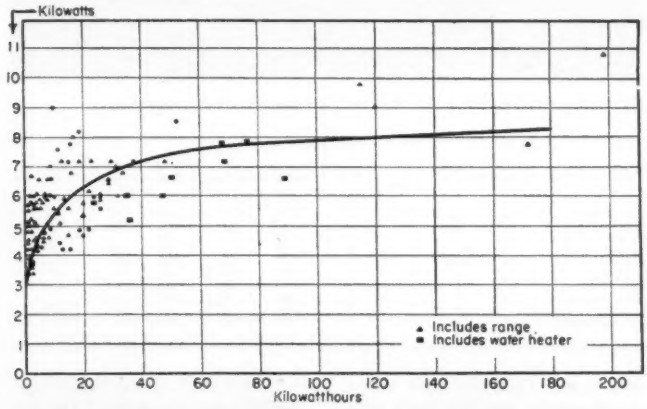


FIG 8—FEW KWHR PER MONTH were used above 3-kw demand for loads of 20 kw and less having lighting, small appliances, and a range or a water heater

Thirty-three companies became sufficiently interested in the possibilities of this new register to cooperate in an experimental program. These companies made test installations consisting of standard demand meters and standard watthour meters with the special registers attached. Findings from these test installations for a period of approximately one year ending in March 1950 were reported by 10 companies for 187 residential and 40 rural customers. Reporting companies operate in the District of Columbia, Minnesota, Mississippi, Ohio, Oregon, Pennsylvania, Texas, Washington and Wisconsin.

Data accumulated represent a total of 907 monthly readings and give pertinent information on the relationship of demands to kwhr use, load factors and the kwhr used at the higher demands. The findings offer material for consideration by those studying the possibility of new forms of rates based on demand and cost of service. The data should also be useful to distribution engineers in the calculation of transformer, secondary and feeder requirements.

Fig 1, 2, 3, and 4 show load characteristics of customers as determined from the standard demand meter and the standard kwhr meter readings. Load factors determined from the average curve of Fig 1, 2, 3, and 4 are

Residential Kwhr Use Data For the Higher Demands

Data indicate revenue obtained to pay cost of added facilities for handling these demands.

Group No.	Major Appliances	Connected Load, Kw	Maximum Demand, Kw	Kwhr Per Kw	Months Total Use	Premium Kwhr Use as Percent Total Kwhr, For Part of Load Exceeding: 1 Kw	3 Kw	5 Kw	10 Kw
	Domestic Consumers								
1 (5)	None	7.6	3.9	135	527	23.4%	0.4%	*	.....
2 (4)	Water heaters	7.7	3.6	151	540	27.1%	2.7%	*	.....
3 (25)	Ranges	14.8	5.3	92	485	26.6%	2.7%	0.5%	.....
	Combined, Weighted Averages of Groups 1, 2, and 3	12.9	4.7	106	502	24.7%	2.1%	0.3%	.....
4 (19)	Range and water heater	16.5	6.7	104	692	32.8%	4.3%	2.0%	.....
5 (16)	Range, water heater, small portable space heaters	25.0	6.4	115	730	33.1%	4.7%	0.7%	.....
	Combined, Weighted Averages of Groups 4 and 5	20.4	6.5	108	706	33.0%	4.5%	1.4%	.....
6 (18)	Range, water heater, large space heating	32.0	10.3	160	1,642	.....	.....	14.7%	0.8%
	Rural (Farm) Consumers								
7 (40)	Wide variety	15.5	4.8	140	670	18.0%	3.3%	2.0%	*
	Commercial Consumers								
8 (10)	Wide variety	10.8	10.0	264	2,640	††	††	20.3%	2.6%

* Less than 0.1%.
†† Percentages for one commercial consumer omitted.
The number of consumers in each test group is shown in parenthesis with each Group Number.

plotted in Fig 5 against monthly kwhr use. An example of data obtained with the new register is given in Fig 8. The last four columns of the table provide a numerical summary of these data for the first nine months of the tests.

15-Amp Meter for Low-Use Customers. . . Test results show that the probability of gaining long-range economies greater than the loss in revenue caused by light-load inaccuracies justifies the use of the 15-amp, 2-wire/3-wire meter on low-use consumers, except possibly for the "minimum bill" customer. Connected for 2-wire, 120-v operation, such meters have a 7.2-kw capacity at 400% of normal rating, compared with the 2.4-kw capacity of a 5-amp rating, both at nearly the same first cost. Reconnected for 3-wire, 240 v, it has 14.4-kw capacity at 400% of normal rating.

Electric Pumps Reclaim Ohio Marshland

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Toledo Edison Co
Toledo, Ohio

Electric pumping is turning marshland into valuable farm property in the service area of the Toledo Edison Co. There are two general types of land that are being thus drained, land close to Lake Erie and subject to overflow, and land farther away without outlets for under-drainage. Because of the kind of soil and the level topography, surface and internal drainage are also poor.

Before drainage, this land supports only marsh vegetation. Drained, soya beans, tomatoes, sugar beets, corn, small grains, and alfalfa can be grown on it.

Over the whole area there is a slope towards the lake of about 5 feet to the mile. Canals and tributary ditches have been dug for general drainage and much land has thus been reclaimed. But there still remain many pieces of land in marsh because of lack of slope towards existing canals and ditches. Such land, when tiled and ditched, has no natural drainage outlet and the water just stands in the ditches. It might even be that water would back up in the ditches if connection to a neighboring canal were made. Thus the water has to be removed by pumping into a main drainage stream. The lifts for this purpose are usually small, not more than 7 or 8 feet, and for this an automatic, electrically-driven, centrifugal pump is admirably suited. The accompanying table of representative installations gives an idea of costs and operations.

PUMPING WATER into main drainage stream reclaims marshland

Name of Farmer	Acres Drained	Pump Size, in.	Motor hp	Maximum Lift, ft	Pump & Motor	Pumphouse	Total Cost	Kwhr Per Mo	Kwhr Per Mo Per Acre
Pete Wilhelm	155	12	7½	7	$394	$475	$869	65	.42
Otto Klaese	40	8	5	7	456	221	677	75	1.87
Milton Weidner	40	8	5	7	362	160	522	....	....
Palme-Roberts	80	10	5	5	339	None	339	158	1.98
Ira Jones	25	Sump	2	6	300	100	400	239	9.16
Ira Hartman	80	10	5	6	295	100	395	140	1.75
Frank Wolfe	160	10	7½	8	634	80	714	562	3.50
Wake Matthews	130	6	3	7	270	30	300	....	....
		8	5	7	395	50	445	384	2.95
Geo. F. Metzger	66	10	7½	7	650	300	950	260	3.95

How Series Capacitors Can Improve Today's Transmission Performance

Recent developments and experience in switching and protection of series capacitors has rekindled interest in their use to improve conditions on transmission systems. The following pages discuss fundamentals of their application to power systems

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Westinghouse Electric Corp, East Pittsburgh, Pa.

Fundamentally a series capacitor compensates for the voltage drop, or part of the drop, through the inductive reactance of a circuit. Load current through its negative capacitive reactance causes a voltage drop opposite to that carried by the circuit inductance. Such compensation is valuable: (1) On radial feeders to reduce voltage drop (voltage regulation) and light flicker; (2) on tie feeders to increase their ability to transfer power and give better system stability; and (3) on parallel tie feeders to force a desired load division between feeders.

Effects on Radial Feeders . . . How a series capacitor reduces voltage drop is shown in Fig 1. Voltage drop through the resistance and inductive reactance of a feeder is approximately

$$E_d = IR\cos\theta + IX_L\sin\theta \qquad (1)$$

R is feeder resistance, X_L feeder reactance and θ the power factor angle. If the second term of equation (1) equals or exceeds the voltage improvement desired, a series capacitor may be applicable. The second term is a relatively larger part of the total voltage drop in instances where the power factor is low and where the ratio of

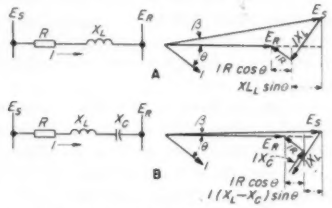

FIG 1—VECTOR DIAGRAMS for a circuit of lagging power factor (A) without and (B) with series capacitors. Series capacitor increases receiving-end voltage, reducing voltage drop

feeder resistance-to-reactance is small. If a series capacitor inserted in the circuit as shown in Fig 1B, the voltage drop becomes

$$E_d = IR\cos\theta + I(X_L - X_C)\sin\theta \qquad (2)$$

In most cases capacitive reactance is made smaller than feeder inductive reactance. If the reverse is true, overcompensation exists. Overcompensation has been used, where feeder resistance is relatively high, to make the second term of equation (2) negative. This may not be a satisfactory condition if the amount of capacitance is selected for normal running load. For example, during the starting of a large motor, lagging current may cause an excessive voltage rise as demonstrated by Fig 2. This can be harmful to lighting and may introduce light flicker.

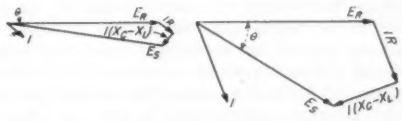

FIG 2—HIGH LAGGING CURRENT due to motor starting rapidly raises receiving-end voltage of a circuit which is over-compensated

Load power factor of a circuit must be lagging if a series capacitor is to reduce voltage drop appreciably between sending and receiving ends. If power factor is leading the receiving-end voltage is actually decreased by adding a series capacitor as seen in Fig 3. If the power factor is near unity, sin θ is substantially zero and therefore a series capacitor would bring comparatively little voltage improvement to radial feeders.

Properly applied a series capacitor offsets the reactance of a line and so raises the delivered voltage. This increases the kva capacity of a radial feeder. For the same delivered load kva it reduces line current slightly. However, a series capacitor is not a substitute for a larger line conductor.

Series capacitors are particularly suited to radial circuits where light flicker is caused by rapid, repetitive load fluctuations due to frequent motor starting, electric welders and electric furnaces. The sudden voltage drop that causes light flicker is compensated almost instantaneously by a series capacitor and in the same manner as drop due to a slowly increased load.

The series capacitor, like any other voltage-regulating device, cannot significantly improve or alter voltage conditions on the source side. To reduce light flicker at a

given load point, therefore, the series capacitor must be on the source side of that point in order to compensate for line inductance between the source and the point where the light flicker is objectionable. This sometimes complicates series capacitor application where one feeder

FIG 3—FOR LEADING POWER FACTOR, a series capacitor is undesirable because it results in decreased receiving-end voltage

from a bus with several feeders serves a fluctuating load that causes enough voltage change on the bus to make lights flicker on all feeders. For a bus having more than one source, series capacitors may be required in all sources.

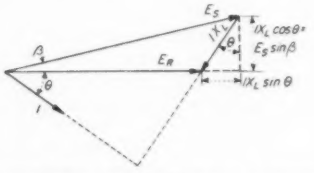

FIG 4—VECTOR DIAGRAM for a tie feeder in which the resistance effects are neglected

Effects on Tie Feeders . . . Series capacitors are being applied to tie feeders today to increase power-transfer ability and improve system stability. For simplicity let us assume system impedance consists only of inductive reactance and overlook the negligible effect of resistance in most tie-feeder circuits since it will not affect the results materially. Then, referring to Fig 4, a simplified equation for power through a tie feeder can be written

$$P = E_R I \cos\theta = E_R \frac{E_S \sin\beta}{X_L \cos\theta} \cos\theta = \frac{E_R E_S}{X_L} \sin\beta \qquad (3)$$

where β is the angle between the sending and receiving voltages. With a series capacitor this equation (3) includes a term for capacitive reactance thus

$$P = \frac{E_S E_R}{X_L - X_C} \sin\beta \qquad (4)$$

Thus for a given phase angle difference between the sending and receiving end voltages, the power transfer is greater with a series capacitor.

By making possible a greater interchange of power, normal load transfer and synchronizing power during transient conditions are increased, thereby improving system stability. The transient benefits of series capacitors in a tie transmission line are shown in Fig 5 and 6.

Fig 5 shows transient power-angle diagrams for an assumed system with two parallel lines and an intermediate bus. Fig 6 is for the same system but with a series capacitor at the intermediate bus.

With no fault on the system of Fig 5 and all line sections in service, the crest of the transient power-angle diagram is 1.60 per unit. With a double-line-to-ground fault on the system at the indicated point, maximum power is reduced to 0.50 per unit and with the faulted line section removed from service, the maximum is 1.30 per unit. Assuming that the transmitted power is initially 1.0 per unit, the system operates at point *a* on the power-angle diagram with an angular displacement of 38.5 degrees. The double-line-to-ground fault reduces the transferred power to that indicated at *b* and causes the machines to swing with respect to each other, increasing the angular displacement. In the time required to clear the fault, the angular displacement increases to *c*, and when the fault is cleared, the transferred power increases to *e*. The equal-area criterion of stability postulates that the system is stable as long as the area *abcd* is less than area *def*. Area *abcd* represents the accelerating or disturbing force, and *def* represents the restoring force. The system is on the verge of instability when the areas are equal.

In Fig 6 where series compensation has been added, the crests of the power-angle diagrams for the "no fault" and "faulty line switches out" conditions are higher than in Fig 5, because of the presence of the series capacitor. With no fault and all line sections in service, the maximum power with the series capacitor is 2.0 per unit compared with 1.60 per unit in Fig 5. The power-angle curve for conditions during the double-line-to-ground fault is the same in both figures since the capacitor is assumed to be short circuited for the duration of the fault in Fig 6. It is, however, assumed to be restored to service immediately upon clearing of the fault.

The sequence of events in Fig 6 is similar to that for Fig 5. The initial operating point is at *a* for 1.0 per unit power transfer, it moves to *b* when the double-line-to-ground fault occurs. During switching of the faulted line section, angular displacement increases, moving the operating point to *c*. When the fault is cleared and the capacitor restored to service, the operating point is moved to *e*. Comparing the disturbing force represented by area *abcd* with the restoring force represented by area *def*, it is obvious that the restoring force in Fig 6 is much greater than in Fig 5. This demonstrates the greater stability of the series compensated system.

Thus, the series capacitor can be considered as permitting the accomplishment of one of two basic results.

1. The system transient-stability margin can be increased for a given amount of transferred power; ie, the system becomes more stable.

2. For the same degree of transient stability or the same relative stability margin, the amount of transferred power can be increased.

While a series capacitor in a radial circuit is of little value unless the power factor is lagging, the power factor of the tie transmission line loading is relatively unimportant. This can be seen from equations (3) and (4). Power flow or power transfer through a tie circuit is affected primarily by the angle between the sending and receiving voltages and not so much by power factor.

Parallel Tie-Feeders . . . Frequently, situations are encountered where several parallel tie circuits exist that do not divide the total load according to their capacities. For example, two parallel lines may be identical even to the size of conductor except that one is longer than the other. The longer line has the higher impedance and will not, of course, carry its proportionate share of the

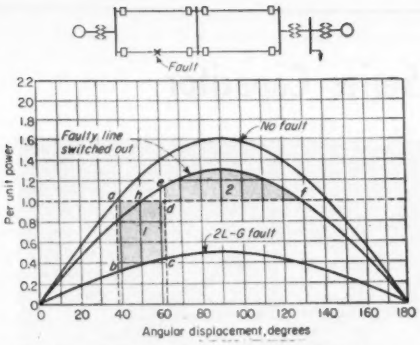

FIG 5—WITHOUT SERIES CAPACITORS, system shows effects on stability due to switching out a line section following a double line-to-ground fault. Area def is about equal to area abcd and system is on verage of being unstable in this case

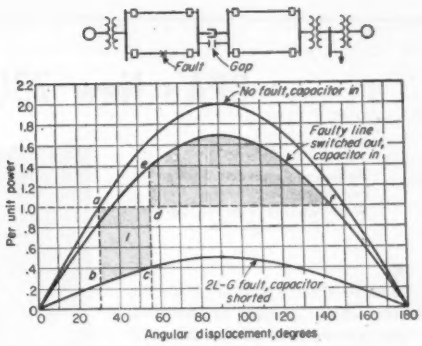

FIG 6—WITH SERIES CAPACITORS, system of Fig 5 is now much more stable as shown by fact that area def is much greater than area abcd. Normal power transfer is same in Figs 5 and 6, but restoring force (area def) is much greater than in Fig 5

load. In another case the lines may be of equal length, but one has a considerably larger conductor. Here line impedances will be about the same and the two lines will carry approximately equal currents even though the larger conductor has more capacity.

To use the conductors in parallel circuits efficiently, it is desirable that the circuits share the total load in proportion to the individual circuit current capacities. In the first case cited, the lines should carry equal currents; while in the second, the large conductor should carry more current than the small conductor. Reactors could be used in the low-reactance for load balancing, but this has objections since over-all circuit impedance is increased. Thus voltage regulation may suffer, reactive losses are increased, and system stability margin is decreased.

Line reactances can be equalized to better advantage by using a series capacitor in the high-reactance circuit or in the circuit that is capable of being more heavily loaded. The series capacitor improves system voltage conditions and system stability and reduces system reactive losses.

Effect on Power Factor . . . The leading kva supplied by a series capacitor improves system power factor just as a shunt capacitor or an overexcited synchronous machine, but to a much smaller extent. In effect, the series capacitor compensates for the I^2X_L lost in the feeder inductive reactance. The amount of I^2X_L and I^2X_C, varies with the current through the circuit. For heavy currents, I^2X_L and I^2X_C are large and for small currents they are much smaller. Usually the compensation in kva obtained from a series capacitor is less than the kva required to supply the I^2X_L of the circuit.

A series capacitor is used to reduce the voltage drop in a feeder and is not applied primarily to correct system power factor. A shunt capacitor on the other hand is usually applied to correct the power factor and in so doing raises the voltage level at the point where it is applied.

Arrangement of Capacitor Units . . . A series capacitor for a given application must generally meet two requirements; (1) It must have enough capacitive reactance (X_C) to provide the proper amount of compensation; (2) it must have enough current capacity to carry the feeder current. Series capacitor banks are made up of conventional capacitor units connected in parallel and series to give the correct value of X_C and the correct current rating. The voltage rating of the units is more or less incidental, being the product of X_C and the rated current. Individual units are connected in parallel to provide the proper current capacity, and parallel groups are connected in series to provide the proper value of capacitive reactance or capacitive voltage drop at rated current.

Series capacitor banks can be assembled for almost any current and capacitive reactance rating using standard shunt capacitor units, although some combinations of ratings may be more economically assembled using nonstandard units. If voltage drop across a bank is less than 230 v, it is usually economical to install a series step-up transformer to permit using standard capacitor units of higher voltage rating and lower cost per kva. This results in a series capacitor of lower current rating and capacitive reactance.

A series capacitor must be insulated from ground to withstand full line-to-ground voltage. However the insulation within the capacitor assembly need only be sufficient to withstand the maximum voltage drop (I_C X_C) across the assembly.

Series Capacitors Location . . . A series capacitor can be located at any convenient place on a feeder if certain requirements are met. Voltage level at output terminals of the bank must not be too high for the line insulation and lightning arresters. A capacitor on a radial feeder must be located between the source and the load where it is desired to improve the voltage. Where a radial feeder has a number of tapped loads distributed throughout its length, the best location for the series capacitor is usually about $\frac{1}{3}$ of the electrical impedance of the feeder from the source bus. For a long feeder, two banks of capacitors may be preferable to provide more uniform voltage throughout the feeder length. If the short circuit current is high it may be advisable to locate the capacitor so that

BPA's New 230-kv Series Capacitor

R. E. MARBURY
Manager Capacitor Section
Switchgear Engineering Dept
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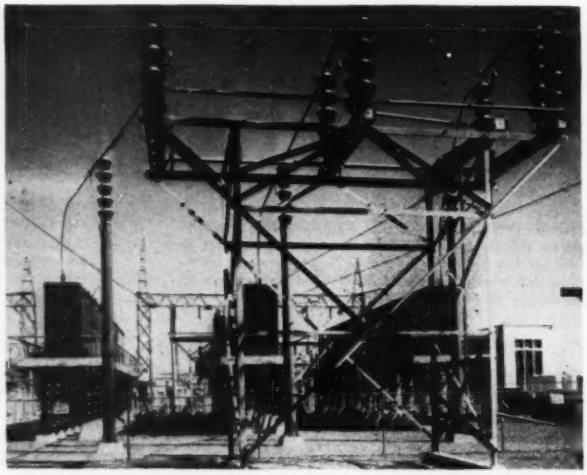


THREE-PHASE SERIES CAPACITOR installation and overhead bus structure at Chehalis substation consists of six 2,500-kvar capacitor groups arranged two per phase. Capacitor units are 15 kvar, 7,960 v

The first series capacitor installation for the purpose of increasing the power limits of a transmission line and the first series capacitor of any kind installed in a 230-kv line in the United States has now been made on the Bonneville Power Administration system at Chehalis, Washington. ("Electrical World," March 12, p 85)

A similar size series capacitor was installed on a 230-kv line in Sweden about a year ago, but special application requirements eliminated the need for means of instantaneous re-insertion of the capacitor after line faults, as a basic function of the by-pass protective equipment. This is a novel feature of the BPA installation.

The Bonneville series capacitor consists of six 2,500-kvar single-phase, 7,960-v metal clad capacitor assemblies, arranged two per phase. The two 2,500-kvar groups may be operated two in series providing a reactance of 51 ohms for a continuous phase working current of 312 amp or they may be operated in parallel providing a reactance of 12.7 ohms for a working current of 624 amp. The capacitor units used are 15-kvar, 7,960-v rating and the housings provide room for adding additional units to increase the rating of the series capacitor by approxiately 50%.

Each 2,500-kvar group is protected by means of a newly developed air blast by-pass gap employing compressed air as a major factor in its operation. It is the function of this gap to provide the means of limiting the voltage across the series capacitor during periods of line fault and yet restore the apparatus almost immediately to normal service after the fault has been cleared—even though the line containing the series capacitor is never actually de-energized. In the BPA installation it was considered desirable to restore the series capacitor to normal eeffctiveness during the first half cycle following the clearing of the fault.

[These gaps are set to break down at 2½ times the normal housing rating or 2.5 x 7,960 = 20 kv rms. Actually the gap setting is such that application of 20 kv several times in succession will not cause breakdown, but the application of 22 kv will usually cause breakdown.—Editor]

This series capacitor was first energized on February 22 this year and on February 25 a number of power faults were initiated on the 230-kv circuit to test the effectiveness of the by-pass protective equipment. These tests showed the installation to be free of corona and the by-pass equipment operated to re-insert the series capacitor in the half cycle following the clearing of the faults. The faults were cleared by reducing the current through the series capacitor to normal, without de-energizing the line.

fault current through the protective gap and switches is a minimum.

A series capacitor can be connected in each phase on the neutral ends of wye-connected transformer windings where the neutral ends of the transformer windings are available and have the proper insulation. Such application permits the use of a lower class insulation to ground for the series capacitor bank. However, it raises the level of voltage to ground on the transformer windings and this must be given consideration. But for compensating circuit inductance, the series capacitor is just as effective in the neutral of the transformer winding as it is in a circuit connected to the transformer terminals.

Protection During Faults . . . In most circuits where series capacitors are or may be applied, fault currents and cor-

responding capacitor voltages are several times the maximum working values of the capacitor units. Standard capacitor units can withstand 200% rated working voltage for short period without damage to the dielectric. Thus, if no protective gaps are used the continuous current rating of the capacitor installation must be equal to 50% of the maximum fault current that can exist. Such application of capacitor units however is practically always uneconomical because the fault currents are usually so much higher than the normal load current and therefore protective devices in parallel with the capacitor units are justified. Such protective devices usually consist of a gap and means for reinserting the series capacitor into the circuit after the fault current has disappeared.

Care must be used to see that the voltage ratings of the series capacitor and its associated protective equipment high enough so the capacitor is not bypassed during normal working loads. On radial circuits to insure availability of the series capacitor during motor starting periods when its effects are most useful, the capacitor rating must be at least 67% of the greatest motor inrush current that may be imposed on the line plus other operating load. With the protective devices set to bypass the capacitor at 200% rating, the capacitor remains in service during such short-time overcurrent conditions.

To protect series capacitors adequately during fault conditions they must be bypassed during the first half cycle of fault current. A properly designed bypass gap fulfills this requirement. Such a gap must be made of materials which will give a stable arc and a low arc drop without repetitive restriking.

On large series capacitors in transmission tie lines special gaps or special high speed circuit breakers, or both, may be required to protect the capacitors and reinsert them into the circuit within a half cycle or cycle after the fault is cleared. This is necessary to enable the series capacitor to be most effective on system stability. If the capacitors are not reinserted within a cycle or less their full benefit can not be realized and their usefulness on tie lines would be reduced materially both electrically and economically.

The average working current through a series capacitor should not exceed the rated working current by more than 5%. Since the protective parallel gap is not set to bypass the series capacitor at less than 200% of the rated current, it will not protect the series capacitor for continuous overloads between 100% and 200% rated current. Therefore it is sometimes desirable to provide overload protection in addition to short circuit protection. The overload protective devices should have an inverse time current characteristic that can be coordinated with the capacitor to allow momentary overloads but not continuous overloads. The capacitor units have a 30-min rating of 1.35 times rated current and a 5-min rating of 1.5 times rated current. Overload protection usually is not warranted except on large series capacitor banks. This means that on the small distribution applications emphasis should be put on proper selection of the capacitor so that it will not be subjected to continuous overloads.

Dielectric failure protection should be considered particularly for large banks. It is a means of detecting a faulted capacitor unit in an assembly. The individual capacitor units should, and usually do, have individual fuses. In the event of a defective unit the fuse will remove a unit from the bank. At rated circuit current the remaining units will have a higher voltage across them. This excessive overvoltage can be detected and the capacitor bank removed from service for reinsertion of new units in place of failed units. Detection can be by potential devices across the series capacitor assembly. Also the capacitor assembly can be divided into two equal branches and a current balance relay can be used to detect current unbalance.

Operating Problems . . . In addition to the desirable characteristics of series capacitors there is the possibility of undesirable phenomena usually involving some kind of resonance. In many cases such difficulties can be anticipated and suitable precautions taken to make the installation practical. Three major phenomena may be encountered employing a series capacitor, namely subsynchronous resonance of a motor during starting, ferroresonance of a transformer, and hunting of a motor during steady state operation. One, two or all may occur.

When an induction or a synchronous motor is started (the latter as an induction) through a series capacitor, the rotor may lock in and continue to rotate at a speed below normal. This condition is known as sub-synchronous resonance. It is caused by the capacitor whose capacitive reactance, in conjunction with the inductive reactance of the circuit and motor, establishes a circuit which is resonant at a frequency below that of the power supply system. The rotor of the motor receives power at rated frequency, which it returns to the system through the series capacitors. Where large motors are supplied through series capacitors this situation should be given consideration. It usually can be eliminated by connecting a suitable resistor permanently in parallel with the series capacitor.

Ferro-resonance in transformers may exist when a transformer bank is energized. The harmonics in the exciting current to the transformer may create a resonance condition back to the supply through the series capacitor. Ferro-resonance is cured automatically in most cases by the short-circuit protective gap in parallel with the capacitor units. The gap will flash over, and as the exciting current decreases the gap current decreases to the point where it is too small to maintain an arc and therefore the gap will clear. If the gap is inadequate this condition can be cleared by connecting a resistor permanently in parallel with the series capacitor bank.

The hunting of a lightly-loaded synchronous motor can be caused by such disturbances as switching of the power circuits, changes in load or changes in excitation of the motor. Such hunting can be directly attributed to resonance. If the ratio of feeder resistance to total feeder reactance (including the series capacitor) between the power source and the motor terminals is less than one and is not negative, hunting is unlikely.

Hunting may also occur with either synchronous or induction motors driving reciprocating loads such as pumps and compressors. In such an event a special study is required to determine the best corrective measure. One cure would be the installation of a heavy flywheel to increase the rotating mass. But with such a solution the possibility of sub-synchronous resonance becomes more likely and should be fully evaluated.

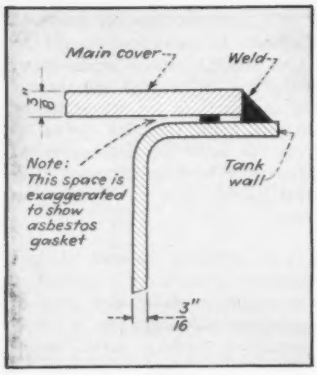


FIG 1—WELDED-ON MAIN COVER with compressed-asbestos gasket

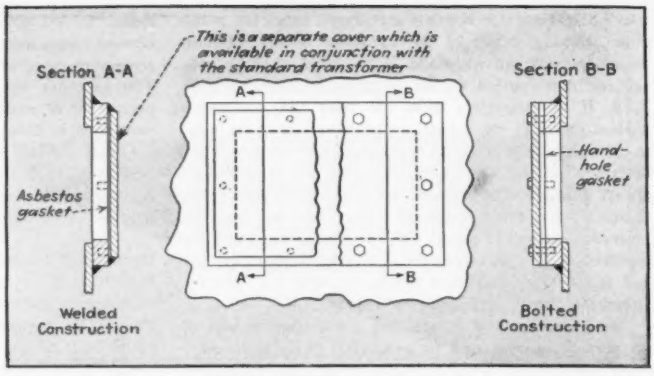


FIG 2—BOLTED-ON HANDHOLE COVER was adopted to allow access to high-voltage connections during installation; handhole covers for welding may be had

New Subway Transformer Standards

To cost-conscious utility operators seeking quality and simplicity of design the new standard offers

- **Fewer Ratings**
- **Hermetic Sealing**
- **Welded Covers**
- **Standardized Manhole Openings**
- **Bushing Features**
- **Uniform Accessory Locations**

M. W. GHEN
Duquesne Light Co

R. D. RUNG
Westinghouse Electric Corp

Co-Chairmen, EEI-NEMA Subcommittee on Subway Transformer Standards

The first EEI-NEMA Standard for Conventional Subway Type Transformers has just been issued.

To the utility operator the new subway transformer standard promises many advantages in addition to the lower cost made possible by the adoption of a standard transformer. Utilities today are looking for operating equipment which can be installed with a minimum of field work and that can be operated and maintained at the lowest practicable cost. Simplicity and quality are the key aims of today's operator. They are the twin words that best describe what the new standard has to offer.

The new Subway Transformer Standard is limited to conventional subway-type transformers: 167 kva and smaller single-phase and 150 kva and smaller three-phase; high voltage 2,400-15,000 v; low-voltage 600 v and below.

The three objectives sought in formulating the standard were these:

1. A basic or standard transformer embodying essential features, with additional equipment available as accessories when required.

2. A subway type unit which would approach, as nearly as possible, a hermetically-sealed case having a minimum number of gasketed openings.

3. Recognition of prevailing trends in underground transformer design which are of proved merit.

For the sake of uniformity and adaptability, this First Report on conventional subway-type transformers follows as closely as possible, the Fourth Report on overhead transformers. The number of ratings, both single-phase and three-phase has been reduced from those specified in the overhead Fourth Report. This is desirable because of the larger percentage of total cost represented by the tank in the construction of small units. Higher installation costs and generally higher loads in the areas in which subway units are used also justify a smaller number of ratings.

Welded Covers . . . The committee found that gasketed joints were responsible for a high percentage of failures. This indicated that a hermetically sealed unit seemed like a logical goal as new techniques had been developed which made it possible to remove or reweld a cover in about the same time required for the bolted and gasketed construction. However, since it would always be necessary to remove a welded-on handhole cover at time of installation in order to make the high-voltage connections, the new standard specifies a welded-on main

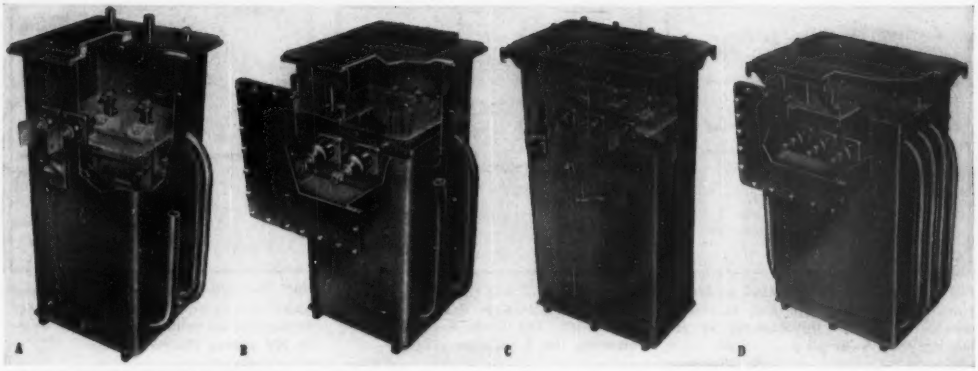


FIG 3—(A) 5-KV SINGLE-PHASE has HV wiping sleeves on cover; (B) 7.2-kv single-phase has HV wiping sleeves on terminal chambers; (C) 5-kv 3-phase has HV wiping sleeves on covers; (D) 7.2-kv 3-phase has them on the terminal chamber

Offer Simplicity, Uniformity, Economy

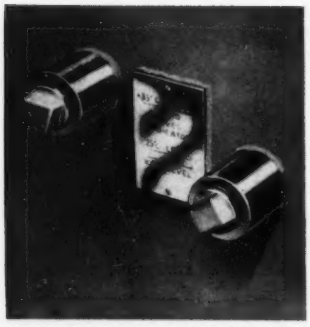


FIG 4—OIL LEVEL INDICATOR for all ratings has plate showing 25 C level; points to plugs at 85 C and 10 C levels

TABLE I—Dimensions of Manhole Openings in Standard Network Transformers

Single-Phase			Three-Phase			
Rating, Kva	5,000 v Delta and Below 8,660 v Wye and Below	5,001 to 15,000 v Delta 8,661 to 15,000 v Wye	Rating, Kva	5,000 v Delta and Below 8,660 v Wye and Below		5,001 to 15,000 v Delta 8,661 to 15,000 v Wye
				Vertical Construction	Horizontal Construction	Horizontal Construction, In.
15	27-in. Diam Round	30-in. Diam Round	15	30-in. Diam Round	33-in. Square	37 x 26
25	30-in. Diam Round	36-in. Diam Round	45	33-in. Diam Round	38-in. Square	53 x 33
50	30-in. Diam Round	42-in. Diam Round	75	33-in. Diam Round	41-in. Square	53 x 34
100	33-in. Diam Round	42-in. Diam Round	150	40-in. Diam Round or 38-in. Square	48-in. Square	60 x 36
167	40-in. Diam Round or 38-in. Square	50-in. Diam Round				

cover (Fig 1) but a bolted-on handhole cover (Fig 2). Separate handhole covers, suitable for welding will be available to users who desire the all-welded construction. Welded construction therefore is used wherever possible and high-voltage wiping sleeves are welded or brazed directly to the tank cover or terminal chamber.

High-voltage terminal chambers were found to be necessary on the higher voltage units to maintain necessary electrical clearances. However, further study of this matter may make it possible to eliminate these terminal chambers and so reduce the over-all dimensions of the units.

Both single- and three-phase transformers with high-voltage ratings 5,000-v delta or 8,600-v wye and below use the general construction shown by Fig 3 and 5. Transformers with high-voltage ratings 5,001 delta to 15,000-v delta or 8,661-v wye to 15,000-v wye use high-voltage terminal chambers as shown by Fig 3B and 3D.

Filling material of mineral oil or various compounds for these high-voltage terminal chambers are not included as a part of the standard.

Manhole Openings . . . The manhole opening requirements given in Table I were adopted as standard. They represent a compromise as they satisfy the requirements of the large majority of users and require design changes in some ratings for practically all transformer manufacturers. By locating high-voltage wiping sleeves on the tank cover or on the top of the terminal chamber, over-all dimensions were kept to a minimum in order to pass as large a unit as possible through a given size manhole opening. To keep within these dimensions, height had to be increased for some ratings.

Tank Construction and Finish . . . The committee gave serious consideration to the tank materials with the aim of

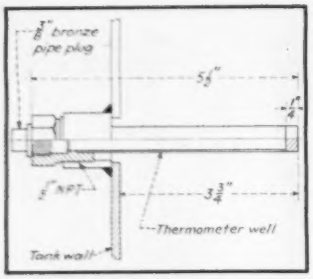


FIG 5—THERMOMETER WELL on larger transformers permits the user to install standard dial-type thermometer by removing the ⅜-in. plug

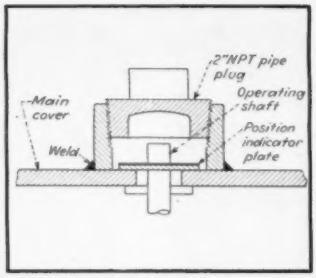


FIG 6—SEALED ACCESS to tap changer operating mechanism has been proved in service. The shaft is accessible by removing the 2 in. pipe plug

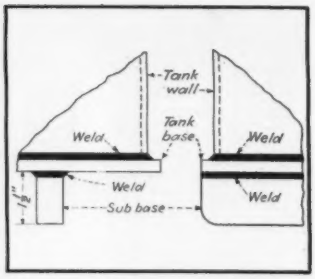


FIG 7—SUB-BASE on standard unit gives a 1½-in. clearance from floor. Is suitable for rolling unit at right angle to HV wiping sleeves

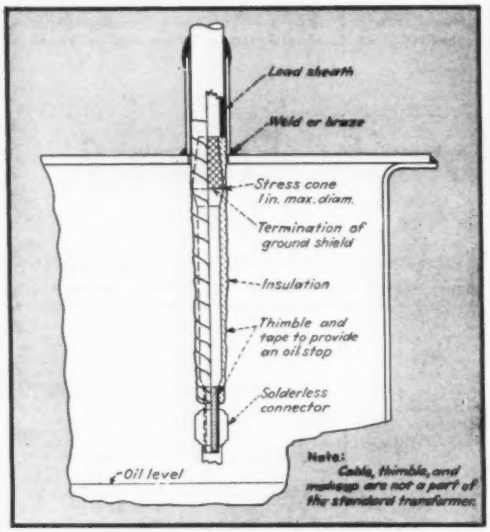

Lead sheath
Weld or braze
Stress cone 1in. max. diam.
Termination of ground shield
Insulation
Thimble and tape to provide an oil stop
Solderless connector
Oil level
Note: Cable, thimble, and makeup are not a part of the standard transformer.

FIG 9—HV CONNECTIONS for 5-kv single- and three-phase units with wiping sleeves on the transformer cover

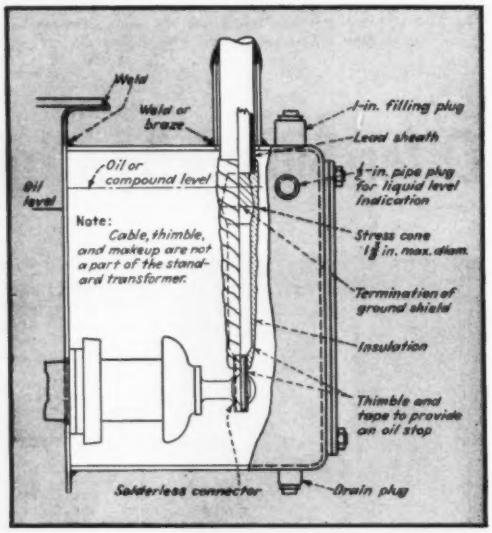
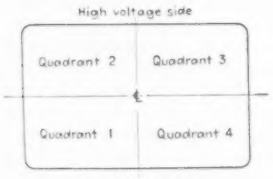

Weld
Weld or braze
1-in. filling plug
Lead sheath
Oil or compound level
Oil level
¼-in. pipe plug for liquid level indication
Note: Cable, thimble, and makeup are not a part of the standard transformer.
Stress cone 1⅜ in. max. diam.
Termination of ground shield
Insulation
Thimble and tape to provide an oil stop
Solderless connector
Drain plug

FIG 10—HV CONNECTIONS for 7.2-kv single- and three-phase transformers; wiping sleeves on top of terminal chamber

TABLE II—Where Accessories Are Located in the New Subway Transformers



LOCATION OF QUADRANTS
Key to placement of accessories in the new subway transformers

Standard Accessory	Quadrant Location	Kva Ratings	
		Single-Phase	Three-Phase
½-in Oil Drain Plug	Centerline 1 & 4	15 to 100 Kva	15 to 75 Kva
Combination 1-in. Oil Drain Valve and Bottom Filter Press Connection	Centerline 1 & 4	167 Kva	150 Kva
Provision for Oil Level Indicators	1	15 to 167 Kva	15 to 150 Kva
Provision for Thermometer	4	100 & 167 Kva	150 Kva
Combination 1-in. Upper Filter Press Connection and Filling Plug	3 or 4	15 to 167 Kva	15 to 150 Kva
Internal Tap Changer*	.....	15 to 50 Kva	15 to 150 Kva
External Tap Changer*	2 or 3	100 & 167 Kva	.....
Provision for Rolling at Right Angle to Line Through High Voltage Terminal Entrances	.....	15 to 167 Kva	15 to 150 Kva
Handhole in Cover	Suitable	15 to 167 Kva	15 to 150 Kva
Grounding Pad for One ½-in. Bolt	1	15 to 100 Kva	15 to 150 Kva
Grounding Pad for Two ½-in. Bolts	1	167 Kva	.....
Adequate Lifting Lugs	Suitable	15 to 167 Kva	15 to 150 Kva

* Available only on ratings having taps as standard.

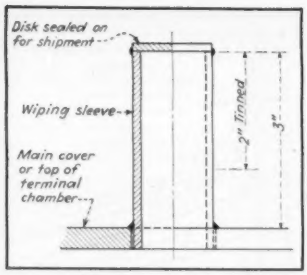


FIG 8—HV CABLE ENTRANCES are tinned wiping sleeves brazed or welded to the tank cover or terminal chamber. Sleeves are not tapered

securing the best corrosion resistant materials which would still be consistent with the cost of subway transformers. New corrosion resistant materials were considered by the Committee but insufficient experience with these materials on underground transformer application made it inadvisable to adopt them at this time.

The tank material specified is copper bearing steel with thicknesses as follows:—

Tank Wall	$\frac{1}{4}$ in.
Cooling Tubes	$\frac{1}{8}$ in.
Cover	$\frac{3}{8}$ in.
Tank Bottom	$\frac{3}{8}$ in.

The finish for these subway transformers is to be of a dark color which shall be resistant to chipping and which shall also be resistant to deterioration under usual underground operating conditions.

Accessory Equipment . . . The location of standard accessories is shown in Table II.

Oil level indicators are not standard accessories as many users felt that this extra expense could not be justified on small subway transformers. Elimination of oil gauges and substitution of provision for oil sampling fittings will result in a much tighter transformer. However an inexpensive liquid level indicator shown in Fig 4 is available for all ratings covered by this First Report. Other fittings may be used in conjunction with sampling fittings to give an accurate oil level indication.

Thermometer . . . Provision only is made for the thermometer on the larger subway transformers because here again there was a question as to just how many users required thermometers. This provision consists of a closed thermometer well as shown by Fig 5. This means that a user can install a standard dial type thermometer on these larger transformers by removing the ⅜-in. bronze pipe plug.

The external tap changer handle used on some of the larger tapped transformers was also given serious consideration in regard to sealing of the opening for the operating mechanism. The committee approved the tap changer operating means as shown by Fig 6 as this design had been proved in service on network transformers. This consists of a shaft for operation of the internal mechanism which extends up through a position indicator plate located on or under the main cover of the transformer and these are accessible by removing a 2-in. pipe plug.

Sub base . . . A sub base (Fig 7) is provided which gives a 1½-in. clearance from the floor. This sub base is suitable for rolling the unit at right angles to a line through the high-voltage wiping sleeves. The unit may easily be rolled in the other direction by using two short planks or other suitable support under it. This type of construction is rugged, is open to ventilation at the two ends, and accessible for cleaning under the transformer base.

High-Voltage Cable Entrances . . . The high-voltage cable entrance (Fig 8) consist of tinned wiping sleeves brazed or welded permanently to the tank cover or to the top of the terminal chamber for the reasons outlined previously. Results of a questionnaire to the users indicated a preference for straight wiping sleeves over tapered sleeves.

All primary cable entrances have been designed large enough to permit the insertion of a completely oil stopped and taped end terminal with adequate stress cone for the higher voltages. These ends should be prepared by using a closed end thimble on the end of the conductor to be terminated and taping from this thimble, just above the clamp, over the insulation and stress cone to the lead. A suitable oil-insoluble compound should be used in this operation to insure keeping the cable oil in place and to prevent siphoning of transformer oil through the cable end as well as mixing of the two types of oil within the cable insulation.

Wiping can be done by packing the space between the inside of the wiping sleeve with asbestos tape or other suitable material before the wipe is made. Some users prefer to install a tight fitting lead ring, some prefer to wipe the joint, while others use a lead "puddling" operation with lead pellets and a suitable torch.

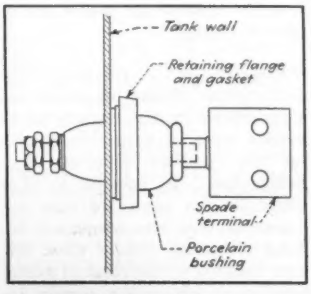


FIG 11—SPADE TERMINAL on low-voltage bushings for making cable connections outside of the transformer

Low-Voltage Bushings . . . Porcelain bushings are provided for the low-voltage terminals to facilitate the connection of heavy cables to a hermetically sealed transformer regardless of the type of cable insulation, thus recognizing the increasing use of rubber, rubber-like and plastic compounds for underground cable. Fig 11 shows spade terminal on low-voltage bushings for making cable connections outside of transformer. Availability of reliable tapes and varnishes makes the termination of all types of low-voltage cables a relatively simple matter.

Low-voltage bushings are, of necessity, gasketed at present but several manufacturers have the development of a permanently sealed bushing under advisement. The design allows the user to attach various types of single or multiple connecting devices or simple plates or other arrangements of his own devising. Some recently advertised putty-like compounds assist in filling in irregularities in connectors and facilitate the taping operation. Paper-lead secondary cables should be oil stopped by using a closed end lug or other sealing method. A number of oil-insoluble compounds are available for the oil stop taping operation, and neoprene or plastic tapes provide additional protection.

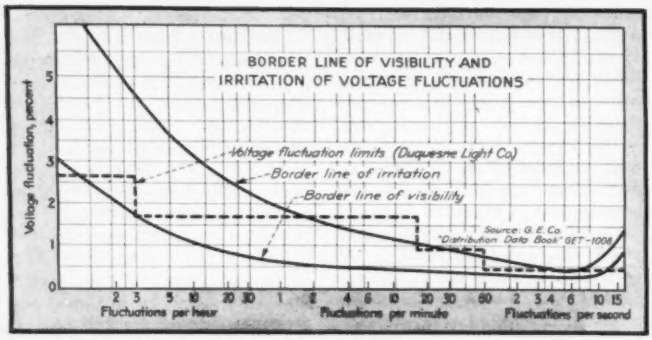

BORDER LINE OF VISIBILITY AND
IRRITATION OF VOLTAGE FLUCTUATIONS
Voltage fluctuation, percent
Voltage fluctuation limits (Duquesne Light Co)
Border line of irritation
Border line of visibility
Source: G.E.Co. "Distribution Data Book" GET-1008
Fluctuations per hour
Fluctuations per minute
Fluctuations per second

FIG 1—THRESHOLD OF VISIBILITY and irritation from flicker compared with Duquesne Light Co's voltage fluctuation limits. Standards for voltage flicker are set up for a rate of fifteen fluctuations per minute to three per hour

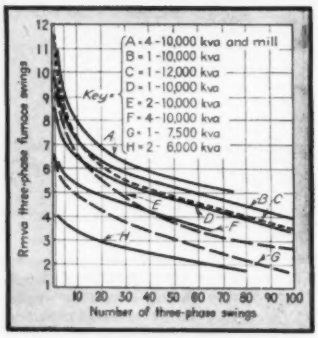


FIG 2—SIZE AND FREQUENCY of three-phase swings of various size furnaces during the meltdown period

Electric Arc Furnace Flicker Can be Overcome

Solutions call for line and transformer capacities to handle the usual swings of arc furnace load, and are obtainable by judicious connections of such load to the sources available, with reinforcements as justified

B. M. JONES, Planning Engineer
Duquesne Light Co, Pittsburgh, Pa.

Electric arc furnaces produce violently fluctuating loads, both single- and three-phase, that vary with the size of the furnace. The supply for such furnaces can involve larger expenditures than other utilization apparatuses that also produce severe load fluctuations.

Four major problems are involved:

1. To provide adequate line and/or stepdown transformer capacity to carry the heating load that the furnace imposes thereon.

2. Similarly, to provide adequate line capacity to handle the violent single- and three-phase load swings and deliver usable voltage.

3. To connect such line extensions into the power system at a suitable location to avoid: (a) Subjecting the furnace customer to non-usable voltage; (b) subjecting other customers to objectionable flicker; and (c) causing objectionable operation of various equipment on the system, such as induction-feeder voltage regulators, governing equipment, tie-line controls, rotating equipment, etc.

4. To reinforce the system and/or lines as required.

Voltage Flicker . . . Duquesne Light Co's voltage flicker standards are superimposed on Fig 1 and apply to various types of utilization apparatus that produce disturbing fluctuating loads. By adhering to these limits for ten years, we have encountered very few complaints because of voltage flicker. These few have been mainly the result of welder installations rather than furnace installations.

These standards specify that for customers supplied at 22 kv and 11 kv, the fluctuation caused by such customers shall not exceed 2 v on a 115-v lighting base measured at the nearest customer, with consideration given to future customers being connected close to the flicker-producing customer; similarly, a limit of 1½ v for customers supplied from the 66-kv system. These values are set up for a rate of occurrence of voltage flicker of fifteen per minute to three per hour, which, we feel, will cover the fluctuation of electric arc furnaces.

Cyclic flicker has been caused by some of the larger furnaces with high secondary voltage, and this cyclic flicker has been reduced to the point where complaints are not received by using slightly lower secondary voltage taps on the furnace transformer. However, it is better for all concerned to have the maximum secondary voltage that does not produce voltage complaints as the maximum available in the transformer, and this will likely require cooperation and coordination between the power customer, the steel company, and the furnace builders. The writer strongly urges such cooperation and agreement before the installation is made.

Furnace Swings . . . The relation of furnace load swings to the size of the

HOW ELECTRIC FURNACES ARE CONNECTED TO DUQUESNE SYSTEM

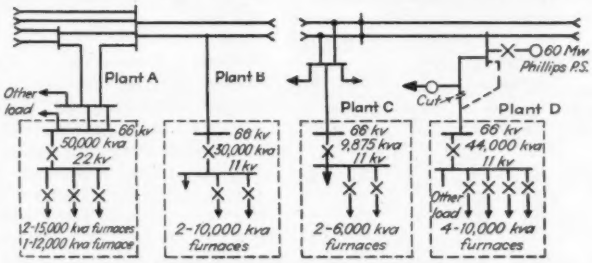


FIG 3—FURNACES OF 6 TO 15 MVA connected to 66-kv system

Plant A . . . These furnaces are connected to an industrial 66-kv, 60-cycle system which interconnects with the Duquesne Light 66-kv system, and two No. 4/0, 66-kv Duquesne Light lines supply the plant. These furnaces are located about 1½ miles from the point of this interconnection.

Plant B . . . This was a wartime plant and it was supplied by a 1/0, 66-kv line extension approximately 2 miles from the main 4/0, 66-kv transmission ring.

Plant C . . . This customer was originally and is now connected to a 4/0, 66-kv line about eight miles long which terminates on Duquesne Light's Valley Substation 66-kv bus.

Plant D . . . This was, and is, a most interesting installation, and the initial 10,000-kva furnace was supplied in early 1940 by an 8-mile, 4/0, 66-kv line extension from the Duquesne Light 66-kv system and a 9,375-kva, 66-kv power bank — all installed for this purpose only. Later in 1940, a second 10,000-kva furnace was installed and an 11,610-kva power bank paralleled with the first bank. Then a year or two later, two additional 10,000-kva furnaces were installed and Duquesne Light just added two more 11,160-kva power banks in parallel with the other two banks.

Later, the customer installed some larger rolling mill motors, and the resultant total load produced considerable *voltage regulation* which, together with the *unbalanced voltage* resulting from the unbalanced furnace fluctuations, caused the relays on the large rolling mill motors to operate, thus shutting down these mills. Interim measures were adopted while corrective measures were taken which consisted of the installation of a 10,000-kva, 66-kv series capacitor in Kennedy Substation in this line about two-thirds of the way (10 miles) from the Phillips Power Station to the customer. Improved voltage resulted from the installation of this 10,000-kva series capacitor.

At a point between the series capacitor and the customer, a 66-kv connection was made and a line extended to a 10,000-kva, 66/22-kv bank in a Duquesne Light substation for local 22-kv load. This was not practical before the capacitor was installed because of the violent voltage fluctuations and the wide range of voltage regulation.

Additional synchronous motors with leading power factor have greatly improved the customer's power factor and regulation.

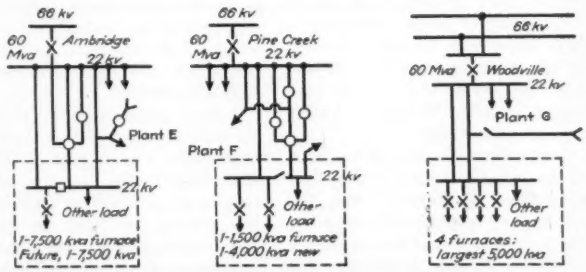


FIG 4—FURNACES OF 1.5 TO 7.5 MVA connected to 66-kv system

Plant E . . . One 7,500-kva furnace was installed in an existing steel plant without other furnaces, which plant had been supplied by three short 22-kv lines about 3.0 to 3.5 miles long each. The furnace was connected to the 22-kv mill bus in a manner so that a 22-kv bus tie breaker could isolate the furnace only from the rest of Duquesne Light's 22-kv system in this vicinity and then supply the furnace from a direct 4/0, 22-kv, 3/5 mile line from the Ambridge Substation.

This bus tie was opened only during the meltdown periods, and this was an hour or so out of the four to six hours time for a complete heat. For the remainder of the time the load was much steadier and the 22-kv system in the vicinity could handle the smaller swings of that plant, so the bus tie was closed.

Later, a second 7,500-kva furnace was connected to the same 22-kv bus and after adjusting the reactance and voltage taps in both the furnace transformers, the necessity for opening the bus tie breaker was eliminated and it has been run closed practically all the time since.

Larger furnaces are scheduled for 1951 and this method will be retained with the same 22-kv reinforcing.

Plant F . . . There was a 1,500-kva furnace in this plant previously which had given trouble for a number of years and which was tied to the regular 22-kv plant bus along with their other load.

Later a 4,000-kva furnace was installed and it was necessary to install a separate 5.5-mile 22-kv line for this furnace alone, and also necessary to install an isolated disconnecting switch in the 22-kv plant bus and to operate this tie switch open to prevent the flicker from the larger furnace causing complaints from nearby residential customer. The regular 22-kv plant bus provides standby for reduced operation of the 4,000-kva furnace.

Plant G . . . The latest furnace was a 5,000-kva unit, which was added about 1941, but three electric arc furnaces from 1200 kva to 3000 kva had been in operation in this plant for 20 to 30 years.

This plant had been supplied for many years by two 22-kv lines, each approximately 2.0 miles long, with connections to the 22-kv network in that vicinity. When the 5,000-kva furnace was added, the customer's load became so large that the two exclusive 4/0 lines were provided.

TABLE I—1943 Transmission Supply Lines, Short Circuit Kva, and Voltage Flicker for 28 Furnaces from 2,500 Kva to 15,000 Kva in 13 plants on Duquesne Light System

		Furnace Transfs.		Line Data		At Incoming Bus			Regulation Based on Inst. Est'd 1-Phase Kva Swing		
									At Cust. Substa.		
Plant	Fig.	No. of Transf.	Largest Transf. Kva	Voltage, Kv	From Network (NW) or Separate (Sep.) Line	3-Phase Short Circuit, Mva	Reactance or Imp., Ohms 3-Phase	Reactance or Imp., Ohms 1-Phase	At Incoming Bus	At Furnace H. V. Bus	At Nearest Critical Station Bus
A	3	3	15,000	68	NW	1,179,000	3.925	7.85	1.53	4.80	1.22
B	3	2	10,000	68	NW	749,000	6.18	12.36	2.00	5.98	.98
C	3	2	6,000	68	Sep.	330,000	14.02	28.04	3.52	3.52	1.78
D	3	4	10,000	68	Sep.	304,000	15.22	30.44	4.98	7.55	1.23
E	4	1	7,500	23	NW	439,000	1.205	2.41	2.99	2.99	2.56
F	4	2	4,000	23	Sep.	103,000	5.12	10.24	8.70	8.70	1.76
G	4	4	5,000	23	NW	388,000	1.33	2.66	2.60	2.60	1.18
H	—	1	5,000	23	NW	165,000	321	6.42	6.27	6.27	2.17
J	—	1	7,500	23	Sep.	132,000	4.01	8.02	9.94	9.94	2.75
K	—	1	3,000	23	NW	319,000	1.656	3.31	2.34	2.34	1.87
L	—	3	3,000	11.5	Sep.	364,000	.363	.73	2.02	2.02	1.48
M	—	2	2,500	23	NW	238,000	2.22	4.44	2.75	2.75	1.04
N	—	2	1,500	23	NW	339,000	1.56	3.12	1.36	1.36	1.02

TABLE II—Single-Phase Load Swings and Power Factors of the Swings for Various Size Furnaces

Furnace Transformer N. P. Rating	Single Phase Swing	
	Load Swing, Kva	Power Factor, Percent
2,000	2,300	43
3,000	3,100	46
4,000	3,800	47
5,000	4,300	50
6,000	5,000	52
7,500	5,600	55
10,000	6,500	60
12,000	7,000	63.5
15,000	7,750	68.5
16,000	8,000	70

furnace transformer is shown in Table II, and desirable size of the system in short circuit Mva for supplying three-phase electric arc furnaces is shown in Table III. This short circuit Mva is at the point on the system where the 1.5 or 2.0-v flicker will occur, which is at the point of furnace connection. These curves are based upon single-phase furnace swings and represent a general guide.

The infrequent high swings shown on Fig 2, occurring once or twice a heat, do not—in the author's opinion—justify extra investment necessary to reduce the resultant flicker, whereas the lower more frequent swings must be provided for by building the system to handle them without complaints.

Maximum swings produced by several furnaces in simultaneous operation in one plant occur very infrequently; less frequently than the one high swing of one furnace operating alone. In specific tests on an installation of four 10,000-kva furnaces in the same plant, the increase of the maximum swings produced by two furnaces melting down simultaneously over one alone was about 20 to 25%. Similarly, for the three similar furnaces over two, the increase was seven to ten per cent additional. We doubt the advisability of tooling up for these one of two maximum swings during the meltdown of one or two hours. Theoretically of course, there will be times when both furnaces are striking the maximum together, but that is of rare occurrence, and we have not tooled up for this and no trouble has been encountered.

Load swings are affected very materially by type of scrap and by how the furnace is operated. Also, the amount of supplemental reactance (the tap connection of the reactor) in use in the furnace transformer has a very material bearing on the magnitude of the swings. Therefore, caution is urged in attempting to use the data in Fig 2, but they will be helpful as a guide.

TABLE III—System Short Circuit Kva at Incoming Bus of Customer's Plant for Voltage Flicker of 2 and 1.5 v on 115-v Base

Furnace Transformer N. P. Rating	Short Circuit Mva at Incoming Bus Of Customer's Plant	
	1.5-v Flicker	2-v Flicker
2,000	350	250
3,000	480	360
4,000	600	440
5,000	690	510
6,000	770	570
7,500	870	650
10,000	980	760
12,000	1,070	840
15,000	1,200	960
16,000	1,240	1,000

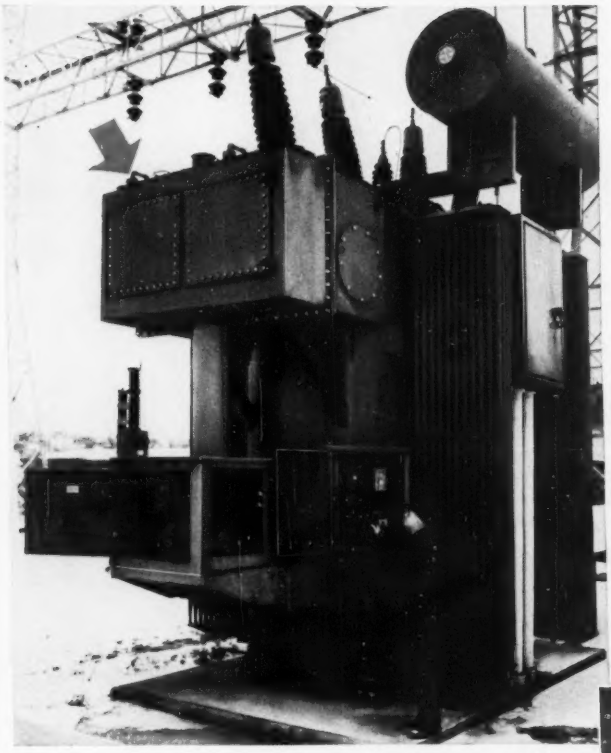
Methods of Connection . . . Various methods of connection have been developed and used by the Duquesne Light Co, and Table I shows the data for 28 large electric arc furnaces in 13 plants, varying in size from 2,500 kva to 15,000 kva. Total kva of all electric arc furnaces (some only 500 kva) now on our system amounts to approximately 170,000 kva. The data on these 28 furnaces are based on 1943 system generating capacity of 624 Mw (nameplate) and now the generating capability is 802 Mw. Two additional units under construction will bring it to approximately 1,000 Mw.

The short circuit kva values shown in Table I were determined on the basis of reactance for overhead lines and 80% of impedance for cables. This is the accepted method of determining short circuit values on our system because our overhead lines are practically all No. 4/0 conductor and have a low ratio of R to X. All items in Table I are supplied by overhead lines except Item 1, which is an all underground supply. Descriptions of the methods of connection for 7 of these plants are included hereinafter, and the system connections are shown.

Voltage calculations are made on the basis of using reactance only and single-phase kva furnace swings at zero power factors, as such calculations result in a voltage drop only a few percent less than the method using resistance and reactance and estimated power factor. System resistance, reactance, and furnace power factors are used in these calculations wherever practicable.

Power Transformers . . . In general power transformers should be applied on an over-size basis rather than just enough transformer capacity because the customer will speed up production and will attempt to get more output to make more profit. The crew will become skilled and the power transformer will very likely become overloaded if it is not fully adequate. Many power and furnace transformers have been replaced with larger trans-

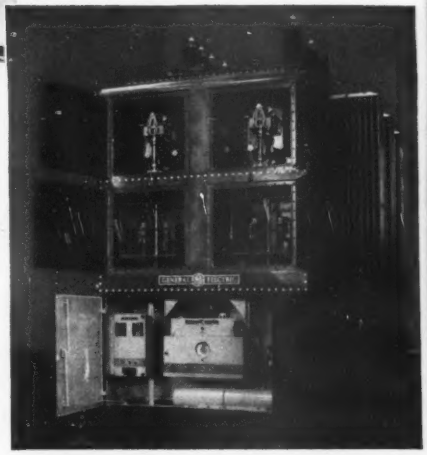
(*Continued on page* 189)



At its current rate of operation the load-ratio-control equipment on this G-E transformer at Lewiston, Maine, will require no servicing until about 1962.

106,554 tap changes since 1947

Arcing tips inspected, found good for 400,000 more operations



On more recent G-E transformers the contactor compartment is below the one for tap selectors instead of in front of it, to further improve accessibility. The motor drive has also been made more accessible and all controls have been grouped on a hinged panel for operating convenience. Basic design, however, remains unchanged, including electrostatic shielding that prevents dangerous carbon deposits.

Central Maine Power Company recently inspected the load-ratio-control equipment on this transformer rated 13,333 kva (with fans), 115,000Y to 12,000-volts. This was the first opportunity the company had to inspect contacts since installation in 1947. The counter read 106,554 tap changes under load. Here are pertinent parts of the report:

> *"Arcing tips are in good condition, and should last 500,000 tap changes as estimated in the G-E Instruction Book. All bearings, pins, cam rollers and cam surfaces are in excellent condition and show no wear. Oil was slightly carbonized and insulating rods and panel showed some carbon streamers, but there were no carbon deposits in the areas protected by electrostatic shielding. Oil was filtered and re-used. Surfaces were cleaned."*

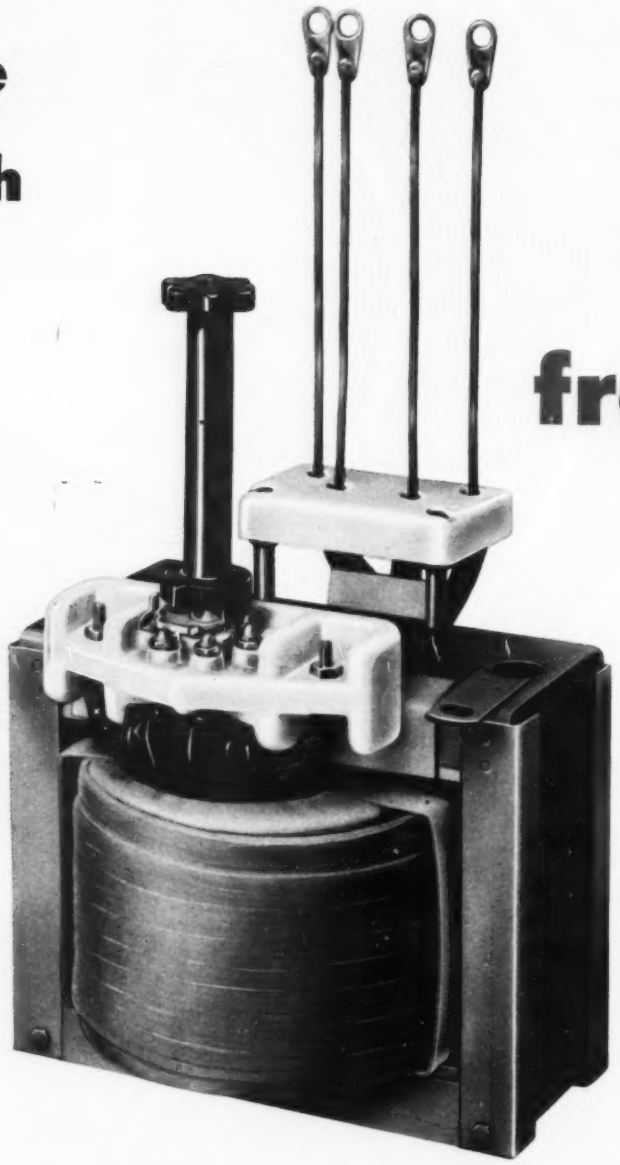
This report is typical. *At its present rate of operation, this equipment will not require further servicing for about 11 more years.* General Electric has now installed load-ratio-control equipment on 37,665,618 kva of transformers—and the reliability record matches the outstanding record of the transformers themselves. *General Electric Company, Schenectady 5, New York.*

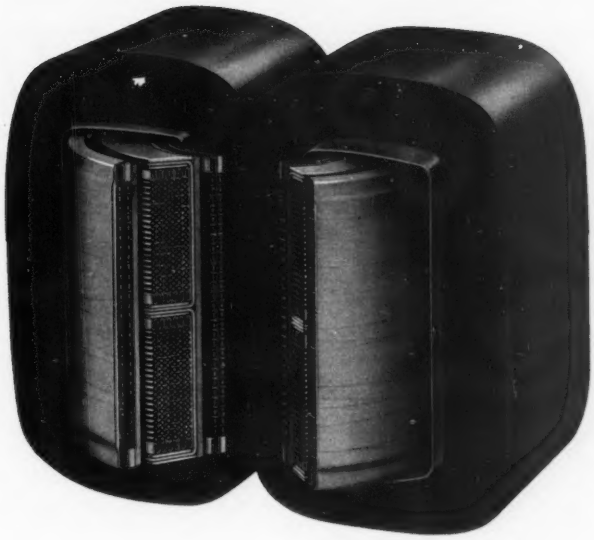
401-20

GENERAL ELECTRIC

SPIRAKORE* TRANSFORMERS

high impulse strength from





improved coil design

If your experience is typical, roughly half of your distribution transformer failures can be charged to lightning. But on your Spirakore* transformers delivered since 1943, you will find that lightning failures have been almost insignificant.

Reason? Eight years ago, General Electric engineers made discoveries about impulse strength that led to a strategic rearrangement of coil insulation and spacing. What that change accomplished *for you* can now be seen in your own records.

Important as this is, it is still only one advantage you get with today's Spirakore transformers. You get a wound core in *all* single-phase and most three-phase ratings—a G-E development that has resulted in direct savings to utilities of millions of dollars. You get an improved clamping construction for greater mechanical strength. You get vacuum-tight sealing that stops breathing, prolongs oil and transformer life. You get an improved Melaglyp† paint that increases durability to weathering by 50 per cent.

All of these changes have kept Spirakore ahead—kept it the standard for others to try to equal. It's the finest distribution transformer you can buy.

General Electric Company, Schenectady 5, N. Y.

*Registered trademark of the General Electric Company.

†A new, greatly improved G-E paint made with melamine-modified Glyptal (registered trademark of the General Electric Co. for alkyd resin).

GENERAL ELECTRIC

402-100

This cutout is liberally designed—has high dielectric strength, uses silver-plated contacts, provides full-range interruption of fault currents, and is conservatively rated as to interrupting capacity. All live parts are completely enclosed for maximum safety.

4 CUTOUTS IN ONE

by simply changing doors

AND THAT'S ONLY HALF THE STORY! By stocking only three interchangeable doors which fit both 5.2 and 7.8 kv, 50-ampere housings, you get the 4 operating functions illustrated below—a total of eight essential cutout combinations! Available also in 100-ampere ratings, this unique flexibility reduces inventory and simplifies stocks.

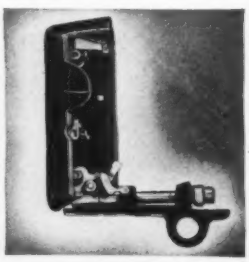
INDICATING OR DROPOUT WITH A TWIST OF THE WRIST! A small wire yoke, easily inserted or removed, determines whether the fuseholder door "kicks out" at the bottom for visual indication, or drops open—either way giving positive evidence of a blown fuse.

RECLOSING DOOR AVOIDS UNNECESSARY SERVICE TRIP! The two-element reclosing door restores service within one second after a temporary fault blows the first fuse link. By avoiding an extra service trip, the two-shot cutout pays for itself the first time it operates!

FLEXIBLE DISCONNECT BLADE CAN'T GET LOST! It's fastened to the door—can't be misplaced. This disconnect blade doubles the continuous current rating of the cutout. When the blade is disconnected and the door closed, the flexible cable extends downward to indicate that the circuit is open.

Only G.E. offers you this flexibility of cutout applications. For complete information contact your G-E sales representative, or write for Bulletin GEA-3448. *General Electric Co., Schenectady 5, New York.*

Indicating


Drop-out

Reclosing

Disconnect

GENERAL ELECTRIC

406-39

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

SMALL TRENCHER is maneuvered into place by two men but . . . **4½-IN. TRENCH** is dug with only one man operating machine

Install Lighting Cable with Trencher to Save Man-hours

O. A. LYBARGER
Asst Supt of Underground Dept
The Toledo Edison Co
Toledo, Ohio

Large labor savings, along with low investment, maneuverability, less soil disturbance, minimum damage to lawns, and portability are advantages found in a small trencher used by the underground department of the Toledo Edison Co. The trencher is particularly suited for installing buried street lighting cable.

The small machine is powered with a 5-hp air-cooled engine and will cut a 4½-in.-wide trench to a depth of 3 ft. The 4½-in. width is sufficient for the cable used, and keeps down the amount of dirt to be back-filled. It will cut through tree roots up to an inch in diameter.

Two men can easily maneuver the trencher into position, and only one man is needed to operate it. When digging to a depth of 20 in., one man and this trencher are equivalent to seven or eight men digging with hand shovels. Since it is comparatively light and mounted on rubber, little damage is down to lawns. Toledo Edison loads the machine on a special small trailer to haul it from job to job.

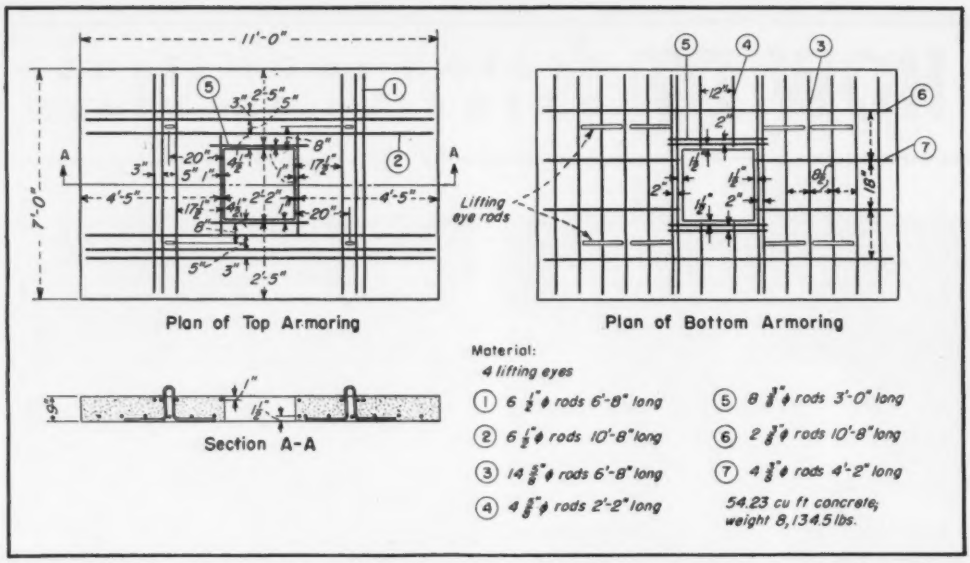
In residential districts the installation of buried underground street lighting circuits has required a considerable amount of hand labor. Such circuits are usually located between the street curb and the sidewalk. With the large number of private driveways, trees, and shrubs encountered, the use of a large size trenching machine would cause considerable damage to lawns. Working around driveways with such a machine would be impracticable.

Precast Manhole Roofs Do Away with Traffic Delays

A. L. HISLER
Gen. Foreman, Underground Conduit Div
Potomac Electric Power Co
Washington, D. C.

The use of precast manhole roof slabs has reduced traffic interference, speeded construction work and improved public relations for the Potomac Electric Power Co in Washington, D. C. Three to six days are saved in concrete curing time for each manhole, permitting replacement of the permanent surface that much sooner.

The roof slabs are made in eight standard sizes at one of our shops. We always try to keep at least one slab of each size on hand for immediate use. Casting the manhole roofs at a central point of operations permits the use of labor familiar with the task. Good working conditions can be easily maintained. Greater accuracy is at-


11'-0"
7'-0"
Plan of Top Armoring
Plan of Bottom Armoring
Lifting eye rods
Section A-A
Material:
4 lifting eyes
① 6 ½"ϕ rods 6'-8" long
② 6 ½"ϕ rods 10'-8" long
③ 14 ⅝"ϕ rods 6'-8" long
④ 4 ⅝"ϕ rods 2'-2" long
⑤ 8 ⅜"ϕ rods 3'-0" long
⑥ 2 ⅜"ϕ rods 10'-8" long
⑦ 4 ⅜"ϕ rods 4'-2" long
54.23 cu ft concrete; weight 8,134.5 lbs.

ARMORING DETAILS of precast roof for 6x10-ft roadway manhole. Precasting minimizes the duration of traffic interference

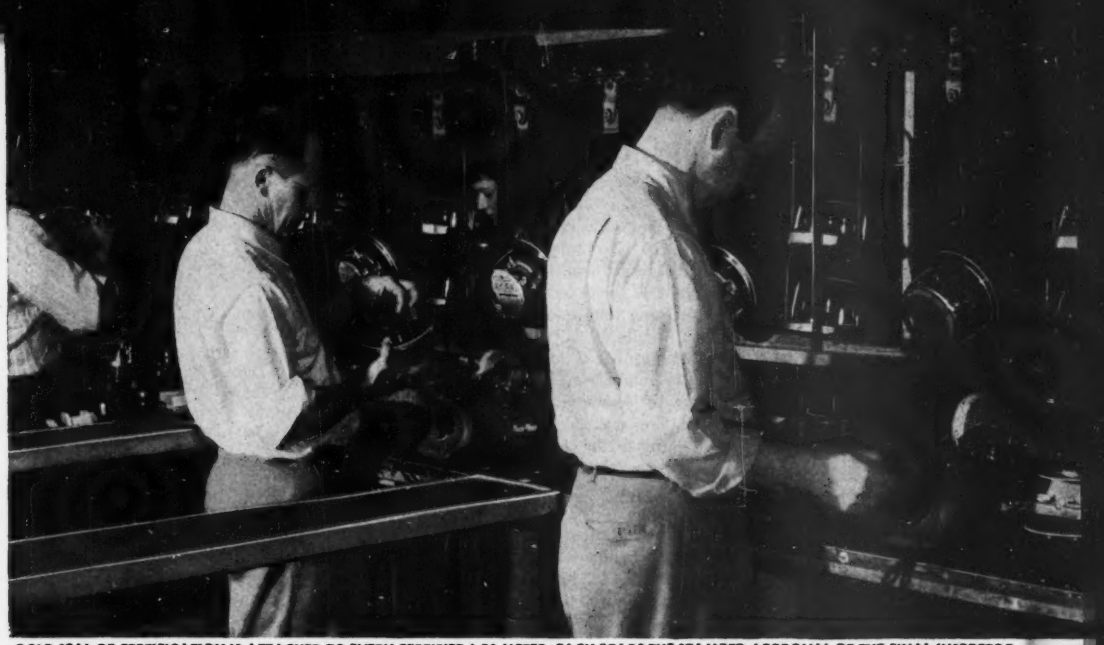
tained when building the forms and placing the reinforcing steel, and it is possible to get a denser concrete than when the sections are cast in the field. These factors tend to give higher structural strength and permit accompanying economies.

In locations where bridging is not used or is impractical to employ, a precast roof slab speeds the work a minimum of three days. Their use is particularly advantageous in the winter months when slabs in span must have thorough curing because of low temperatures and the impracticability of providing heat for curing. The precast roof slab completely eliminates any suspended concrete which is carrying the highway load. Immediately after the roadway surface has been restored the area can be opened to traffic.

Increased use of larger types of transformers with their larger amounts of heat to be dissipated necessitates changing the roof to permit ventilation, or the change from a line manhole to a transformer manhole requires the installation of ventilating facilities. This type of manhole roof replacement has become a one-day operation. The proper size roof is precast and permitted to cure. The old manhole roof is then removed and the precast roof placed with the accompanying roadway replacement the same day. The following day the roadway is opened.

PRECAST ROOF SLAB for roadway manhole saves three to six days in concrete curing time. The lessened traffic interference helps to improve public relations

The precast roof is used whenever possible where manholes are rebuilt and there is considerable energized cable in the manhole. The precast roof eliminates the necessity of any shoring in the manhole. Where the manhole has large cable and it requires racking or reracking, this work can be done much easier where no manhole roof exists. Upon completing the cable work, the roof is simply dropped in place without any conduit labor entering the manhole.



GOLD SEAL OF CERTIFICATION IS ATTACHED TO EVERY CERTIFIED I-50 METER. EACH BEARS THE STAMPED APPROVAL OF THE FINAL INSPECTOR.

I-50 WATTHOUR METERS NOW CERTIFIED

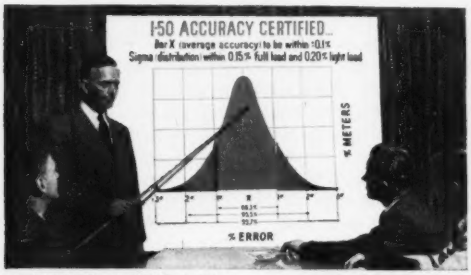
CERTIFICATE SHIPPED in each box is your assurance that I-50 meters are factory certified within prescribed limits.

General Electric factory certifies I-50 meters for both accuracy and performance

Only watthour meters accurate as I-50's can be factory certified within these narrow limits: Bar X (average accuracy) within ±0.1% and Sigma (accuracy distribution) within 0.15% on full-load and 0.20% on light load. Also, 99.9% free from defects that might cause improper registration or operation.

Certification of the I-50 is made possible only because of radical new design features, improved manufacturing techniques, and exacting quality control procedures.

You know that all types of meters are *not* alike—in either accuracy or performance. Why not evaluate and compare your own groups of meters? For complete information, call your G-E representative or write for descriptive bulletin GED-1408; Section 601-76, General Electric, Schenectady 5, N. Y.


I-50 ACCURACY CERTIFIED..
Bar X (average accuracy) to be within ±0.1%
Sigma distribution within 0.15% full load and 0.20% light load
% METERS
% ERROR

CERTIFIED ACCURACY is based on standard method of group evaluation that reduces calibration data to two figures: Bar X (average accuracy) and Sigma (accuracy distribution).

CERTIFIED PERFORMANCE means all meters pass 18 electrical tests, including final tests shown above, and 356 points of inspection. Factory then certifies I-50 meters to be 99.9% free from defects.

GENERAL ELECTRIC

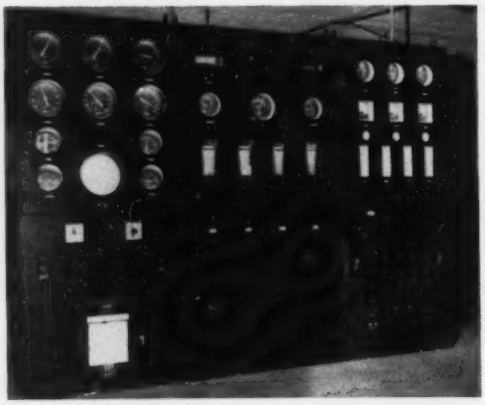
601-76

"Dashboard Lighting" Serves Turbine Control Board

One of the easier-on-the-eye innovations at Consolidated Edison's Waterside generating plant is the indirect lighting feature of turbine control boards. Fluorescent 12-in. tubes, mounted on the rear of the front panel of the board remove the shadows and glare which bothered the readers of the instrument panel's gauges before this renovation was effected.

There are 39 of these 8-w tubes (totaling 312 w) arranged both vertically and horizontally to obtain the best lighting effect. The five vertical lamps, all strategically placed on the hydrogen control panel, are shielded to prevent a direct view of the lamp. Majority of the horizontal lamps are mounted on the rear of the translucent name plates. Panel doors are hinged at top and swing out at the bottom.

The idea to light the boards indirectly was inspired by the lighting used on the dashboard of an automobile. The illustrated control board is 11 ft wide, 7 ft 9 in. high, 2 ft 2 in. deep. This board and another identical to it were installed in 1948. At the present time, four of Waterside's turbine control boards are indirectly lighted.



DASHBOARD-LIKE LIGHTING on each panel of turbine control board is operated by door switch. Panels on board are for turbine gauge, supervisory instruments, hydrogen control

Multi-Service Truck Expands Area Coverage 15%

H. K. WILLIAMS
Superintendent of Distribution
Hartford Electric Light Co

Higher efficiency in overhead maintenance has been achieved by Hartford Electric Light Co with a mobile unit used for servicing overhead traffic signals, working on conductors between poles, replacing street lamps, tree trimming, and even fire emergency rescue work.

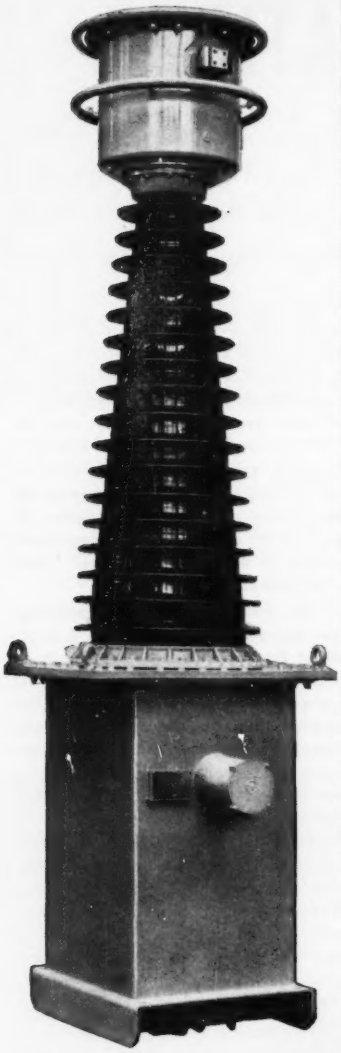
TWO-MAN CREW has relamped 123 highway lights with this mobile unit. Crow's nest reaches a working height of 33 ft

Lifting capacity of the hinged boom is 1,000 lb at the "crow's nest" at a working height 33 ft above ground. The lower and upper beams supporting the crow's nest are 10 ft 7 in. and 10 ft long, respectively. The truck formerly used for street light maintenance had a platform which could be lifted vertically only to a maximum height of 24 ft.

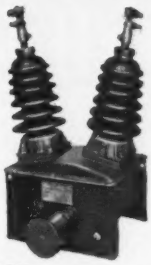
Normally a crew of two man the truck. One man stays in the driver's seat and the other can stay in the crow's nest. This elevated post is 2 ft 6 in. in diameter, 3 ft 2 in. deep. Built of fabricated plywood, it is light in weight and affords some protection for the occupant in case of accidental contact with overhead wires. The lifting mechanism, remote controlled from the crow's nest, has a hydraulic cylinder pressure of 600 psi. It is governed by three manually operated levers which activate oil valves via airplane type control cables. One lever controls the lower boom vertically, one the upper boom vertically, and the third the horizontal swing of the entire unit. The crow's nest remains upright and level at all times. The unit easily reaches over a parked car in a job like street light replacement, and all ladder climbing is eliminated.

When the boom is lowered for traveling it is swung forward over the cab; the elbow bends and the upper end of the upper boom settles into a cradle above the cab. The occupant may either open a door in the right side of the crow's nest and climb down into the seat beside the driver, or he may ride in the crow's nest to the next stop. The total cost of the unit including the truck chassis was about $7,000. A notable safety feature is a latch which prevents the man in the crow's nest from inadvertently setting the boom in motion.

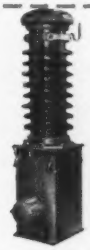
HIGH-VOLTAGE OIL-FILLED
Instrument Transformers



TYPE KC-356
Current Transformer
230,000 volts

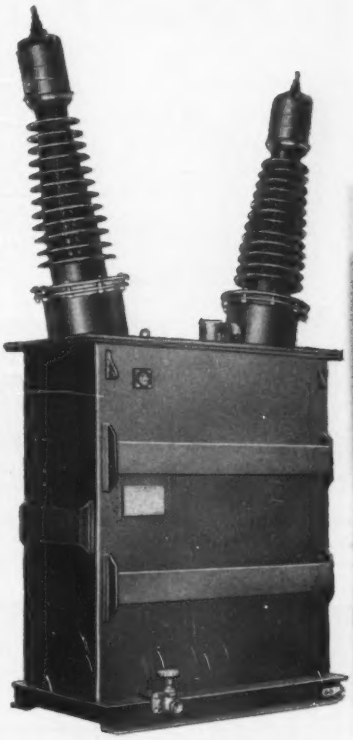


TYPE E-236
Potential Transformer 24,000:120 V.



TYPE KG-9
Current Transformer 69,000 V.

TYPE ET-5
Potential Transformer 14,400:120 V.



TYPE ET-12
Potential Transformer 138,000:115 volts

FOR HIGH-VOLTAGE APPLICATIONS UP TO 287 KV, General Electric offers a complete line of oil-filled instrument transformers. A representative group is shown above. These transformers are available for all types of applications. For further information, contact your G-E representative or write for the new 1951 Instrument Transformer Buyer's Guide, (GEA-4626), Section 604-28, General Electric Company, Schenectady 5, New York.

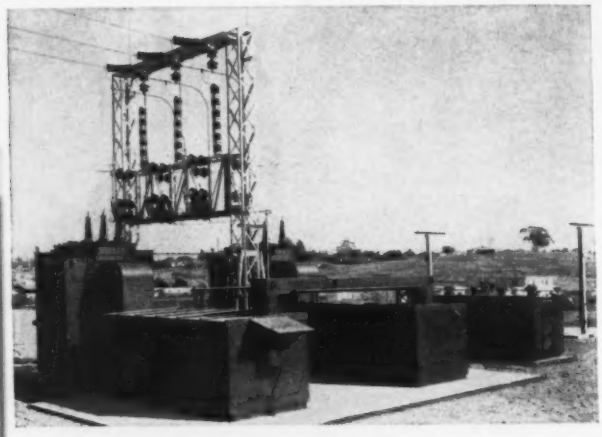
604-38

GENERAL ELECTRIC

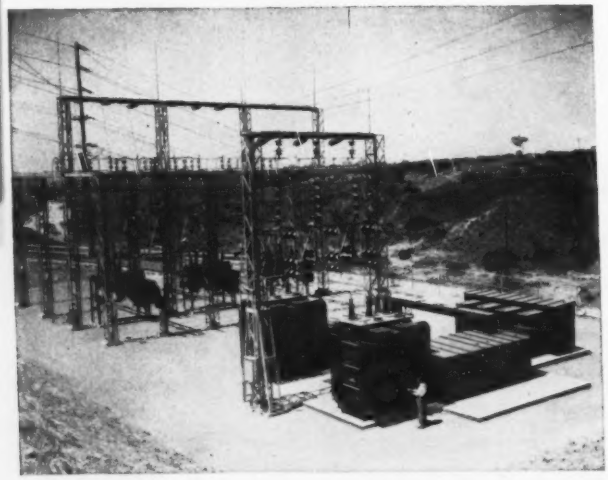
SAN DIEGO GAS AND ELECTRIC

speeds expansion with

PACKAGE SUBSTATIONS



CHOLLAS PACKAGE SUBSTATION, rated 12,000/16,000 kva. Photograph taken from near 69-kv structure shows metal-clad switchgear, 69-kv mounting arresters and horngap switches, and the 125-volt battery house.



WABASH SUBSTATION—constructed completely from packaged equipment, including station structure. This station transforms 69-kv to 4160 volts. Equipment includes two unit substation transformers 5000-kva self-cooled or 6667-kva forced-air-cooled and four 225-kva 3-phase induction voltage regulators operated in triplex.

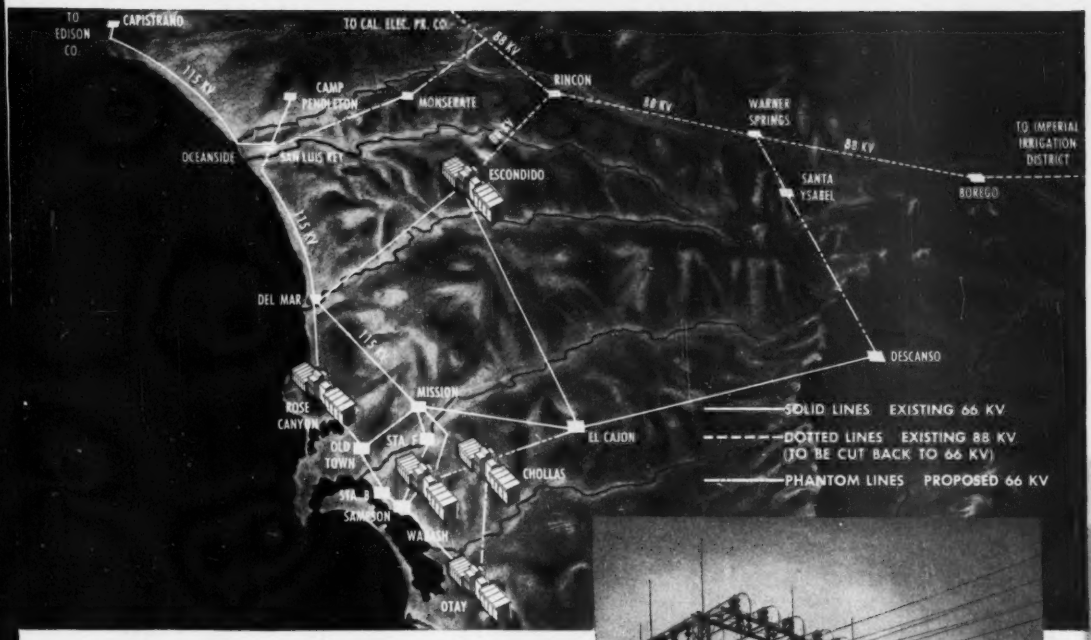
Saves engineering time, simplifies purchasing, speeds delivery to meet tremendous load growth.

Careful planning during the war years enabled San Diego Gas and Electric Company to expand its postwar system with exceptional speed—to meet the huge 350 percent increase in load. Additional generating capacity was the first consideration. But new substation capacity was also urgently needed to relieve badly overloaded equipment and to correct low-voltage conditions on parts of the system. Why did they standardize on **package** substations? Here's what they say:

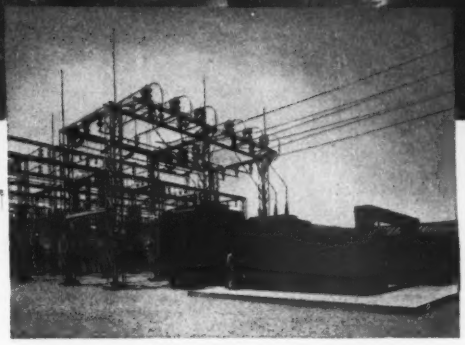
"This method of purchasing minimizes the engineering required since a single set of brief specifications outlining functional requirements is all that need accompany the single purchase order. Ordering all of the equipment from one manufacturer further reduces the engineering time required. It places on the manufacturer the responsibility of co-ordinating all of the various items of equipment and of supplying a workable substation, complete with installation, over-all arrangement, and over-all connection drawings. It frees the utility engineer from the details of co-ordinating and expediting and makes his time available for system planning where he can make more valuable contributions."

These considerations were important to the San Diego Gas and Electric Company. It permitted them, even with a small engineering force, to place orders promptly for complete substations, securing early places in the production schedules.

Apparatus Department, General Electric Company, Schenectady 5, New York.

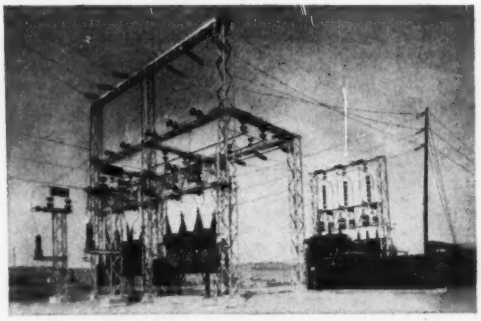


This map shows the planned expansion of the 69 kv transmission system of the San Diego Gas and Electric Co. New package substation locations are shown in red. Substations are functionally similar and made up of standard-design components, the main differences being in secondary voltage and type of regulation. Photographs of the package substations appear on these pages.



(Above) **ESCONDIDO SUBSTATION,** comprising two 3-phase, 66-kv to 12.47-kv, 6000-kva transformers and complete station structure.

OTAY PACKAGED SUBSTATION, rated 12,000/16,000 kva, transforms 69-kv to 12.47-kv. Photo shows current line traps (left) and large outdoor oil circuit breakers, also at left. At right, the transformers, switchgear, Thyrite* station-type arresters, etc.



(Below) **ESCO PACKAGED SUBSTATION,** including induction voltage regulating equipment and a 3-phase transformer rated 3000-kva self-cooled at 12,470/3,430 volts, Y/2,500 volts.

GENERAL ELECTRIC

*Reg. Trade-mark, General Electric Co.

321-72

Typical Transmission Line Characteristics

Important characteristics are listed for typical 60-cycle transmissions lines ranging from 69 kv through 230 kv. These data are suitable for estimating purposes.

ROBERT F. LAWRENCE, Central Station Engineer, Westinghouse Electric Corp, East Pittsburgh, Pa.

Typical Transmission Line Characteristics at 60 Cycles

Circuit Voltage, kv, l-l	Conductor Size, thousands of cir. mils or Awg	Tower Construction*	Equiv. Spacing, ft.	Resistance at 50 C, ohms per phase per mile	Reactance Per Phase Per Mile		Shunt Capacitive Reactance, megohms per phase per mile	Three Phase Charging kva per mile	Surge Impedance ohms, l-n	Surge Impedance Loading (SIL), 3-ph kw
					Ohms	% on 100 Mva 3-ph Base				
69	2/0 Cu	SC-W†	8	0.481	0.7843	1.64	0.1822	26.1	378	12.600
69	336.4 ACSR	DC-ST	11	0.306	0.7420	1.55	0.1750	27.2	360	13.200
69	4/0 Cu	SC-W	14	0.303	0.8112	1.70	0.1902	25.0	393	12.100
69	336.4 ACSR	SC-W	14	0.306	0.7712	1.61	0.1822	26.1	375	12.700
69	336.4 ACSR	SC-ST	19	0.306	0.8083	1.69	0.1913	24.9	393	12.100
115	336.4 ACSR	DC-ST	13	0.306	0.7622	0.576	0.1800	74.7	370	35.700
115	4/0 Cu	SC-W	17	0.303	0.8348	0.631	0.1960	67.5	404	32.700
115	336.4 ACSR	SC-W	17	0.306	0.7948	0.601	0.1880	70.4	386	34.200
115	336.4 ACSR	SC-ST	22	0.306	0.8261	0.624	0.1956	67.6	402	32.800
138	397.5 ACSR	DC-ST	15	0.259	0.7636	0.401	0.1809	105.	371	51.800
138	250 Cu	SC-W	18	0.257	0.8317	0.436	0.1952	97.6	404	47.100
138	397.5 ACSR	SC-W	18	0.259	0.7857	0.412	0.1864	102	382	49.800
138	397.5 ACSR	SC-ST	24	0.259	0.8206	0.430	0.1949	97.7	399	47.600
161	397.5 ACSR	DC-ST	17	0.259	0.7788	0.300	0.1847	140	379	68.400
161	250 Cu	SC-W	19	0.257	0.8383	0.323	0.1968	132	406	63.800
161	397.5 ACSR	SC-W	19	0.259	0.7923	0.305	0.1880	138	386	67.200
161	397.5 ACSR	SC-ST	25	0.259	0.8256	0.318	0.1961	132	402	64.400
230	795 ACSR	DC-ST	22	0.1288	0.7681	0.145	0.1821	291	374	141.000
230	500 HH-Cu	SC-W	25	0.1260	0.7436	0.140	0.1800	294	365	145.000
230	795 ACSR	SC-W	25	0.1288	0.7836	0.148	0.1859	285	381	139.000
230	795 ACSR	SC-ST	31	0.1288	0.8097	0.153	0.1923	275	394	134.000
					Avg. 0.7941		Avg. 0.1878		Avg. 386	

* DC-ST = double circuit — steel tower
SC-W = single circuit — wood
SC-ST = single circuit — steel tower
† Two-crossarm construction forming triangular configuration
All other SC-W are H-frame construction

Specific characteristics for typical transmission lines listed in the table are based on a study of recently constructed lines in the United States. These data are for rough approximation by certain rules of thumb that apply to an "average" line and that can be used for orientation purposes.

Conductor sizes, spacings and type of tower construction represent the most common usage. For the middle value of spacing, characteristics of the aluminum conductor and its copper equivalent are given to illustrate the difference between types of conductors. Spacings given were modified slightly in some instances so as to follow a smooth curve of spacing vs voltage for the different types of construction. Regarding the type of construction, locale apparently dictates the material used.

Following approximations may be applied for estimating specific characteristics of a transmission line:

1. Series reactance of a line = 0.8 ohm per mile.

NOTE—Average of the values for each line in the table is 0.7941 ohm per mile, which indicates that 0.8 is a good approximation.

Percent reactance varies directly with the kva base so that for some base other than 100 Mva, the percent reactance can be determined conveniently.

2. Shunt-capacitive reactance = 0.2 megohm per mile.

NOTE—Average value in the table is 0.1878 megohm per mile, which indicates a rule of 0.2 as a good approximation.

Susceptance, if perferred, is the reciprocal of shunt-capacitive reactance and is in micromhos per mile.

3. Surge impedance of a line = 400 ohms.

NOTE—Surge impedance is numerically equal to $\sqrt{L/C}$, a function of line inductance and capacitance and is independent of length. Average value in the table is 386 ohms. By comparison 400 is a good approximation although as shown in the table it is more representative of the larger stranded copper conductors than it is for the ACSR conductors.

4. Surge-impedance loading, (SIL) in Mw = $(kv_{l\text{-}l})^2/400$ or in kw = $2.5\ (kw_{l\text{-}l})^2$.

NOTE—SIL is (line-to-line voltage in kv)^2 divided by surge impedance. It can be defined as the unit power factor load that can be delivered over a resistanceless line such that the I^2X is equal to the charging kva of the line. Under this condition the sending-end and receiving-end voltages and currents are equal in magnitude but different in phase position. In the practical case of a line having resistance, the magnitude of the sending-end voltage is approximately equal to the magnitude of the receiving-end voltage plus the product of the magnitude of the current and the line resistance; i.e., $E_s = E_R + IR$.

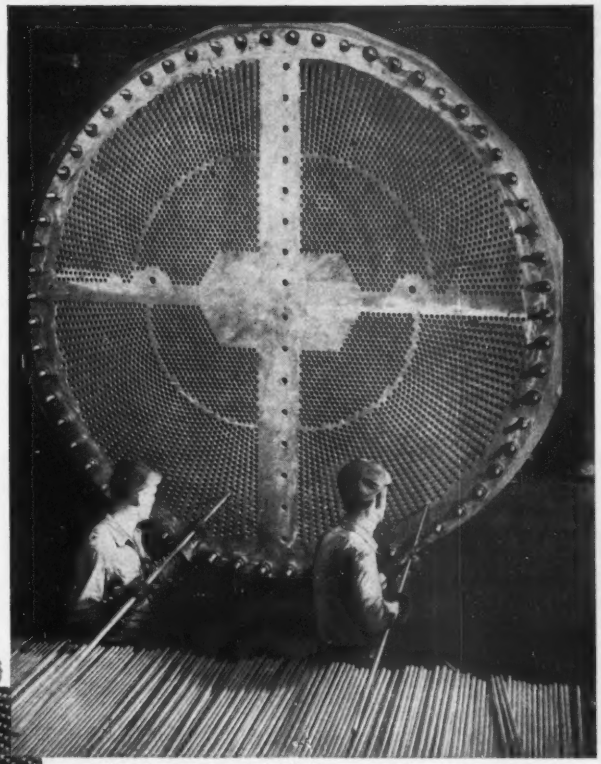
Surge-impedance loading in itself is not a measure of maximum power that can be delivered over a line. Maximum delivered power must take into consideration the length of line involved, the impedance of sending- and receiving-end equipment, and in general all of the major factors that must be considered with regard to stability.

5. (a) Charging kva for a hundred miles of line = 20.5% of the SIL.

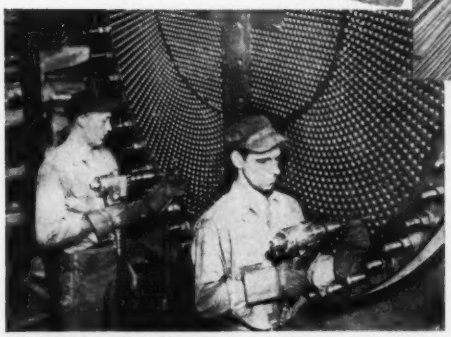
(b) Charging kva of a line = 5000 x $(L/100)^2$ x $Kv_{l\text{-}l}/100)^2$ where L = line length in miles and $kv_{l\text{-}l}$ = line-to-line voltage in kilovolts.

From data in "Electrical Transmission and Distribution Reference Book," 1950 edition, Westinghouse Electric Corp.

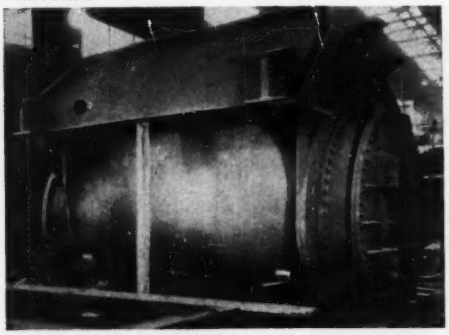
These tubes will stand up...they're REVERE CUPRO-NICKEL



Installing Revere Cupro-Nickel Tubes in a condenser built by Westinghouse Electric Corp., Essington, Pa., for use in a 30,000-ton tanker built for Philadelphia Tankers, Inc., and to be operated by The Atlantic Refining Co. Three of these tankers were built by the New York Shipbuilding Corporation, Camden, N. J.



Rolling the ends of the tubes into the Revere Cupro-Nickel Tube Plates.



Exterior view of one of the tanker condensers. Both main and auxiliary condensers contain Revere Cupro-Nickel Tubes and Plates.

When Philadelphia Tankers, Inc., decided to order three new ships it was determined that they would embody the very best and newest ideas in tanker construction. The final designs included so many novel ideas and important advances that the chief engineer, Dr. Lester M. Goldsmith, was invited to read a paper describing them before the American Society of Mechanical Engineers. However the condenser tubes and tube plates on these ships are thoroughly conventional. These are Revere Cupro-Nickel, the preferred alloy not only for marine use, but in many shore installations where water conditions are difficult. These tubes really stand up.

Whether cupro-nickel should be used on shore depends on the nature of the problems encountered. In some instances another alloy, such as Admiralty, Muntz Metal, Naval Brass, Aluminum Brass may serve as well at less cost in condensers and heat exchangers. Revere will gladly collaborate with you in studying the economics of condenser tube selection as applied to individual installations, new or old.

REVERE 150 YEARS OF SERVICE TO AMERICA

COPPER AND BRASS INCORPORATED

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saving aluminum here

saving of critical materials is not solely the prerogative of the huge giants of Industry. Here is a prime example of how a small Industrial Manufacturer is helping the Central Station Industry make substantial savings of aluminum.

Each pound of Preformed Armor Rods used makes possible a potential saving of 0.7 pounds of critical aluminum. Write on your letterhead for complete details.

Many Utilities are installing transmission lines using 795,000-CM, 26x7 ACSR. When this conductor is installed, using ordinary accessories, there are required at each support:

1—Aluminum suspension clamp without shackle . .	8.20 lbs.
1—Set of tapered armor rods	13.7 lbs.
2—Ovoid clamps @ 0.68 lbs.	1.36 lbs.
	23.26 lbs.

But the equivalent Preformed Armor Rod installation requires only:

1—Smaller suspension clamp without shackle. . . .	6.23 lbs.
1—Set of 0.310" Preformed Aluminum Rods 100" long .	10.08 lbs.
No Ovoid clamps	.....
	16.31 lbs.

saving — 6.95 lbs.

This results in a saving of 30% of critical aluminum. Similar savings develop for all sizes of conductor. And to further reduce the total consumption of aluminum, some Utilities use Steel Preformed Armor Rods on #4 and #2 ACSR.

saving of even [more] aluminum is made possible by using Preformed Armor Rods to:

1. Repair and rebuild transmission lines.
2. Rehabilitate old conductors.
3. Increase the current-carrying capacity of existing lines.
4. Lengthen the life expectancy of present and future lines.

armor rods today assure [more] operating conductor tomorrow

means more miles of conductor . . .

Preformed Armor Rods will . . .

- **INCREASE** the current capacity of splices, conductors in clamps, dead-ends and so on, by more than 30%.
- **LENGTHEN** the life of conductors where vibration, arcing and burning take their toll.

Easily installed in three minutes . . . even by inexperienced linemen . . . Preformed Armor Rods protect conductors better and at lower cost than ordinary armor.

They are better because only PLP rods grip uniformly over the entire conductor length.

They are less expensive because your linemen make perfect installations every time, far quicker than with ordinary armor. Less expensive because only PLP rods eliminate concentrated stresses common in other forms of conductor protection.

Complete technical details and installation records are available. Just write to: *PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio.*

PLP ARMOR RODS ARE AVAILABLE IN ALUMINUM, COPPER, BRONZE, COPPERWELD, STAINLESS STEEL AND GALVANIZED STEEL—A TYPE FOR EVERY CONDUCTOR.

Take half to all of the rods needed and lay them across and around the conductor.

Wrap around conductor several times . . . like wringing water from a cloth. Apply remainder of rods.

Continue wiping action along conductor.

The finished job.

PREFORMED

LINE PRODUCTS CO.

CLEVELAND 3, OHIO

PREFORMED ALUMINUM ALLOY RODS ARE APPROVED BY ALL COMPANIES MANUFACTURING ACSR.

TELESCOPING SIDE LEG of this A-frame is double-hinged. It was designed by BPA for one-man assembly and space economy

CENTER LEG STIFFENERS increase capacity of the A-frame to 16,000 lb when fully-extended to a lift height of 28.5 ft

Double-Jointed A-Frame Takes Little Truck Room

ARTHUR F. WETSCH
Chief, General Shop Unit
Bonneville Power Administration
Portland, Ore.

One-man handling and assembly plus uncluttered space for working or hauling materials on a line truck are benefits of a telescoping A-frame built by Bonneville Power Administration.

It will handle 90-ft poles. Three telescoping pieces of ¼-in. tubing, 3 in., 3⅛ in., and 4⅛ in. O.D. make up the two side legs of the A-frame. Each side leg is permanently mounted on a two-way hinge at the outer end of the truck bed and pivots on its hinge to fold away into the side of the bed. The center leg, which carries the sheave, is made of three pieces of tubing which come apart and store in a recess under the middle of the truck bed. Carrying the tubes in the recess has eliminated the hazard of having them rolling around in the back of the truck.

Side and center legs of the A-frame are drilled for three different lift heights—14.5, 21.5, and 28.5 ft. The inner leg rests on a positioning pin rather than using a match drilled hole and pin all the way through both sections of tubing. This saves time required to line up holes in the two sections so a pin can go all the way through. The pin is simply dropped through the outer leg and the inner leg slides down to rest on it.

One man can assemble the A-frame without assistance. He brings the side legs around to the back of the truck, pins them to the center leg and draws it out to the desired lifting height. The whole assembly is then raised to position by a winch on the back of the truck.

The fully extended A-frame was tested to lift 6,000 lb without distortion. In this position it can handle poles up to 90 ft long. In the two lower lifting positions, lifts of 16,000 lb were made without distortion. With the addition of stiffeners to the center leg, as shown, the fully extended frame also lifted 16,000 lb without any bending or warping.

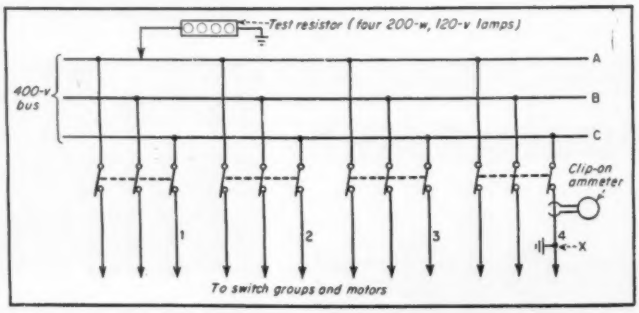
Locating Ground Faults on Station Auxiliary Circuits

B. R. SMITH
Twin Branch Generating Division
Indiana & Michigan Electric Co
Mishawaka, Ind.

At Twin Branch Station a method was devised to locate low-resistance grounds on 440-v ac station auxiliary power feeders without disrupting essential equipment and operating schedules. This power supply system is normally ungrounded. The test method is outlined and the illustration shows how it is applied.

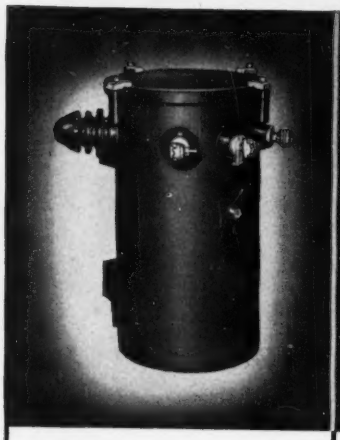
Its advantages are: Uses simple test equipment, is reasonably fast, and requires no outage of healthy equipment. The test current cannot flow through

(*Continued on page* 136)



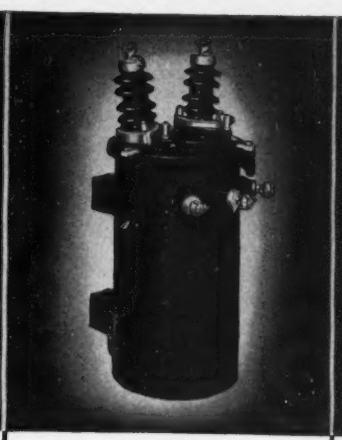
GROUND-LOCATION TEST being applied to a 440-v station auxiliary power supply. Probe of test resistor determines phase at or near zero potential. Probe is brought into contact with bus about twice each second. When pointer of the clip-on ammeter swings in unison with the pulsing test current, the faulty circuit is located

MOLONEY DISTRIBUTION TRANSFORMERS
...for *DEPENDABILITY and PERFORMANCE*



CONVENTIONAL TYPE LL

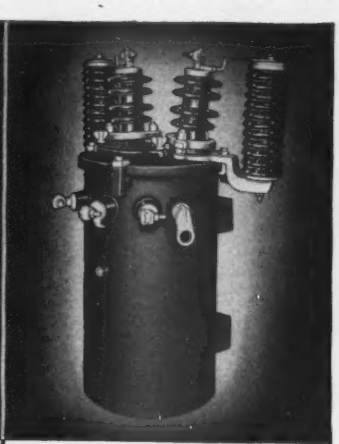
The Type LL Transformer is provided with sidewall-mounted high voltage and low voltage bushings for use on system voltages of 5000 volts or below. These transformers are manufactured in standard Kva ratings from 3 to 100 Kva. Porcelain protective caps are regularly supplied on the high voltage terminals of Type LL Transformers to protect the lineman from accidental contact with the live terminals.



CONVENTIONAL TYPE CL-2

The Type CL-2 Transformer is provided with two cover-mounted high voltage bushings. These transformers are standard in sizes 167 to 500 Kva in all voltages and in sizes 3 to 500 Kva in voltages above 5000 volts.

Transformers with a single cover-mounted high voltage bushing, designated as Type CL-1, are designed for use on grounded neutral systems. One end of the high voltage winding on this type transformer is grounded to the tank internally.



COMPLETELY SELF-PROTECTED

Completely Self-Protected Transformers are equipped with lightning arresters, internal protective links, tank grounding gaps, and secondary circuit breakers. These transformers are available in standard ratings up to 100 Kva and voltages up to 15000 volts. High voltage bushings are sidewall-mounted for voltages of 5000 volts and below and are cover-mounted for voltages above 5000 volts.

The Moloney Electric Company has a transformer to meet the requirements of any distribution system. Recognition of the fact that continuity of service is a "must" on these systems has always been a guide to Moloney engineers in the design of distribution transformers.

Conventional Distribution Transformers are available for those customers who prefer to supply their own protective equipment. For those who prefer integrally mounted protective equipment, there is available a complete line of CSP (Completely Self-Protected) Transformers. Superior electrical performance is assured in all Moloney transformers as a result of liberal design and quality control.

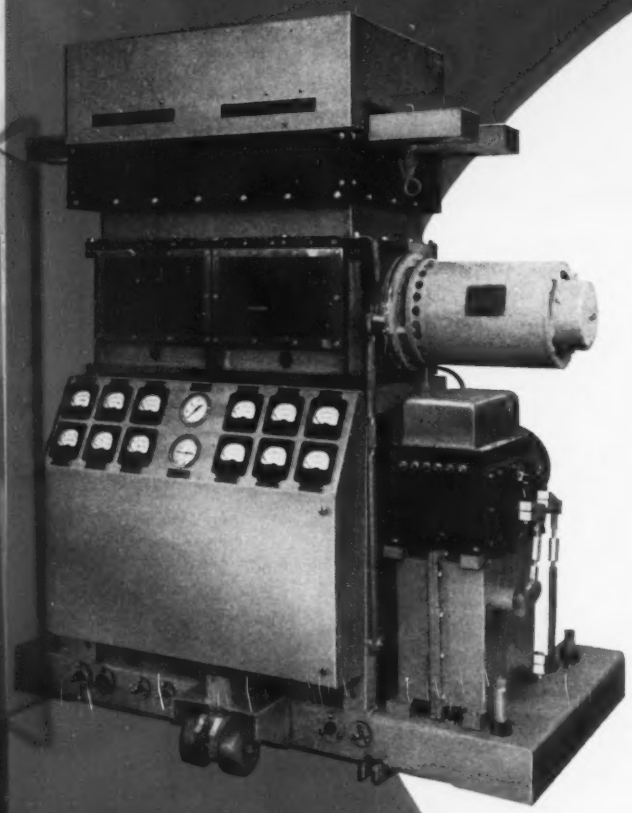
MES1-11

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

SEVEN I-T-E MECHANICAL RECTIFIERS



The heart of the I-T-E Mechanical Rectifier—one 10,000 ampere contact mechanism with contacts enclosed in box on top. Driving eccentric can be seen through windows. At right is the drive motor, with automatic regulator below. The 12 indicating instruments show the timing of each contact while the mechanism is running and carrying load.

I-T-E Mechanical Rectifiers are available in the following ratings: 4,000—5,000—6,000—7,000—8,000—9,000—and 10,000 amperes, in any voltage from 50 to 400 volts d-c. Primary voltages: 2,300 to 46,000 three-phase a-c.

Two years ago, Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y., installed two I-T-E Mechanical Rectifiers, the first mechanical rectification units ever built in this country.

This pioneering spirit of Buffalo Electro-Chemical's progressive management justified itself to the extent that at present I-T-E has orders for five more Mechanical Rectifiers—to augment Buffalo's current modernization program.

I-T-E's Mechanical Rectifier has benefited Buffalo Electro-Chemical—and can handle your low voltage power conversion requirements more effectively.

1 **HIGHER EFFICIENCY**—actually 96% or more in the 100 to 400 volt range, because silver to silver contact minimizes voltage drop in rectifying element.

2 **SPACE SAVINGS**—extremely compact grouping of all operating and protective apparatus.

3 **EASY, LOW-COST INSTALLATION**—unit assembly at factory allows "packaged" delivery, easy installation. No special structural foundations are required; no crane service is needed in rectifier room.

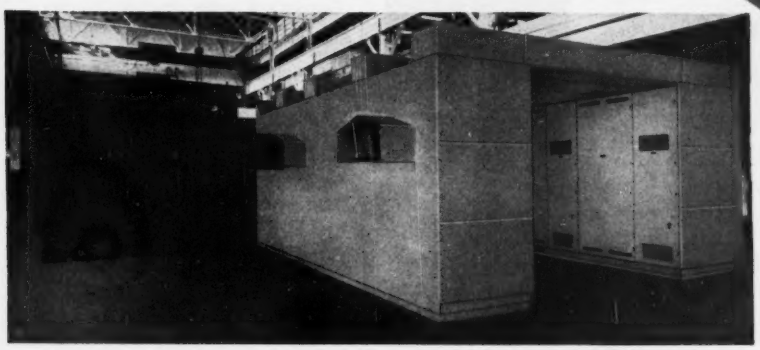
4 **SIMPLE, LOW-COST MAINTENANCE**—maintenance is almost entirely mechanical, requiring no trained personnel, complicated tools or instruments for servicing.

5 **SIMPLE OPERATION**—push-button starting without preliminary warm-up of any kind; immediate connection to load.

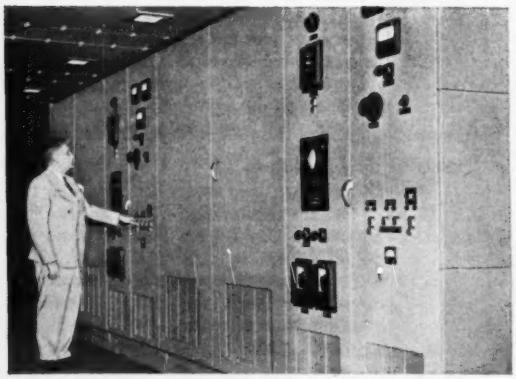
6 **SAFETY**—use of low voltage in your cell room increases safety to operating personnel and equipment.

FOR BUFFALO ELECTRO-CHEMICAL

TYPICAL I-T-E MECHANICAL RECTIFIER ARRANGEMENTS



Factory assembly of two 10,000 ampere units with outdoor transformer (only one of two shown), throat connection through wall rectifier enclosure, operating aisle and d-c switchgear compartments.



Close-up of control and instrument panel. The thoroughness of I-T-E engineering is illustrated by the overhead lights, furnished with the installation and assuring proper illumination of the control panel.

View looking through operating aisle, rectifier enclosure and control panel to left, d-c switchgear to right, interconnecting d-c bus overhead.

I-T-E

R&IE

MECHANICAL RECTIFIERS

I-T-E Circuit Breaker Company, Fifth and Hamilton Streets, Philadelphia 32, Pa.

Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Canadian Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

MECHANICAL RECTIFIERS • SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • RESECTORS • SPECIAL PRODUCTS

Always in Contact!

—with RCA 2-WAY RADIO

MORE COVERAGE

Users' tests prove that it covers greater distances.

GREATER RELIABILITY

Rugged construction stands up under hard usage.

EASIER TO INSTALL AND SERVICE

Mobile unit is not bulky. It's easy to work with. It mounts directly on floor or wall. In cars it mounts on fire wall, on back-seat shelf, in trunks. In trucks, it mounts on wall of driver's compartment, in the freight section, in side lockers.

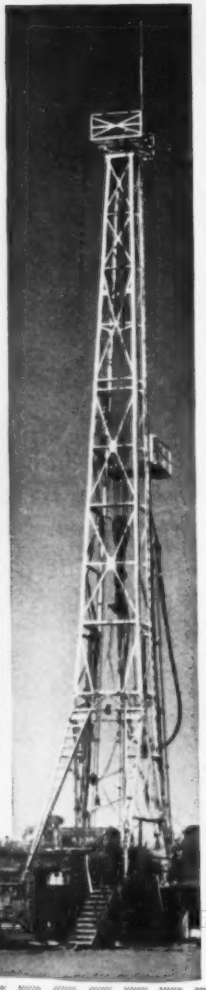
- **Use RCA "CARFONE" for the 152-174 MC band**
- **Use RCA "FLEETFONE" for the 30-50 MC band**

In vehicles

On remote location

Occupies small space. Leaves trunk compartment free for other equipment

At headquarters



For additional information, write: Dept. P-31, RCA Engineering Products, Camden, N. J. (In Canada, write: *RCA Victor Company Limited, Montreal.*)

RCA ENGINEERING PRODUCTS, Camden, N. J. Dept. P-31

Please send me new brochures giving vital facts about RCA 2-way Radio.

Name_____

Company_____

Address_____

City_____ State_____

RADIO CORPORATION of AMERICA

Locating Ground Faults

(*Continued from page* 132)

a defective control coil nor cause it to pick up since transformers isolate the control circuits.

Its limitations are: If the fault is on a bus or incoming connection this method will not locate the trouble, except possibly by a process of elimination. High resistance grounds, such as those caused by moisture, cannot be located by this method. This type of fault is not serious because it usually disappears as equipment dries out rapidly in the torrid atmosphere encountered in most steam plants.

Test equipment consists of: (1) A test resistor composed of four 200-w, 120-v lamps in series with one terminal grounded and the other terminal connected to a flexible, well insulated probe; (2) a clip-on ammeter of suitable range for loads of circuits tested.

Test Procedure

If a ground occurs at some remote point "X" on the radial system, the test resistor probe is used to determine which phase is at or near zero potential. Assuming that C phase is found in trouble, the ammeter is clipped onto that phase in any feeder circuit to indicate the load on this circuit. While the test man observes the ammeter, he brings the test probe into contact with either the A or B bus and then releases it, repeating at the rate of about two times per second. This produces a pulsing current of two amp which flows from the bus through the resistor to ground, thence to the accidental ground at "X" and back through C4 to the C bus. This test current adds to the load already carried by the C conductor and increases the ammeter reading. If the test current is interrupted at a rate corresponding to the inherent swing of the meter, a pulsating test current of 2 amp is readily distinguishable from the load current when the total conductor current does not exceed 250 amp. That is more than the load current of a 150-hp, 440-v motor.

If there is no change in the indication of the clip-on ammeter, it is moved successively to the C phase of other feeders and the test probe is manipulated as before. When the meter pointer swings in unison with the test current, the faulty circuit has been located.

If the faulted circuit feeds a switch

(*Continued on page* 141)

HI-TENSION NEWS *Junior*

A BIG STEP FORWARD
in 22-kv insulation

Now you can bring the many advantages of the O-B Clamptop line post to your 22-kv class construction. Just added to the O-B line post group is a new 8 3/8-inch model incorporating the Clamptop head--the modern successor to troublesome tie wires.

With O-B Clamptops, installation time is cut to a fraction of that required in making a conventional permanent tie. No special skill is required. The only tool needed is a common wrench. Conductor grip is better than a new tie and won't loosen with strain or vibration. Radio noise is brought to a new low level by assuring tight conductor attachment to an inherently quiet insulator. Hot line work is almost as safe and fast as hand working--far superior to a tied insulator--since there are no loose, energized wire ends to deal with, and since the principal tool used is a simple hot stick wrench.

O-B Clamptops are a big improvement in *any* insulator. Now they are added to a popular size of line post of the 22-kv class. You can get easier, cheaper, better construction--simpler, safer maintenance--a higher order of line performance--all by specifying the new 8 3/8-inch O-B Clamptop post on future lines.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

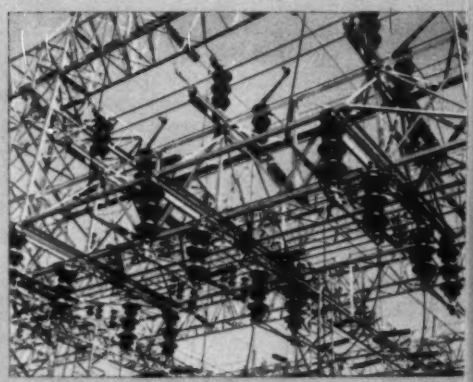
THOREX

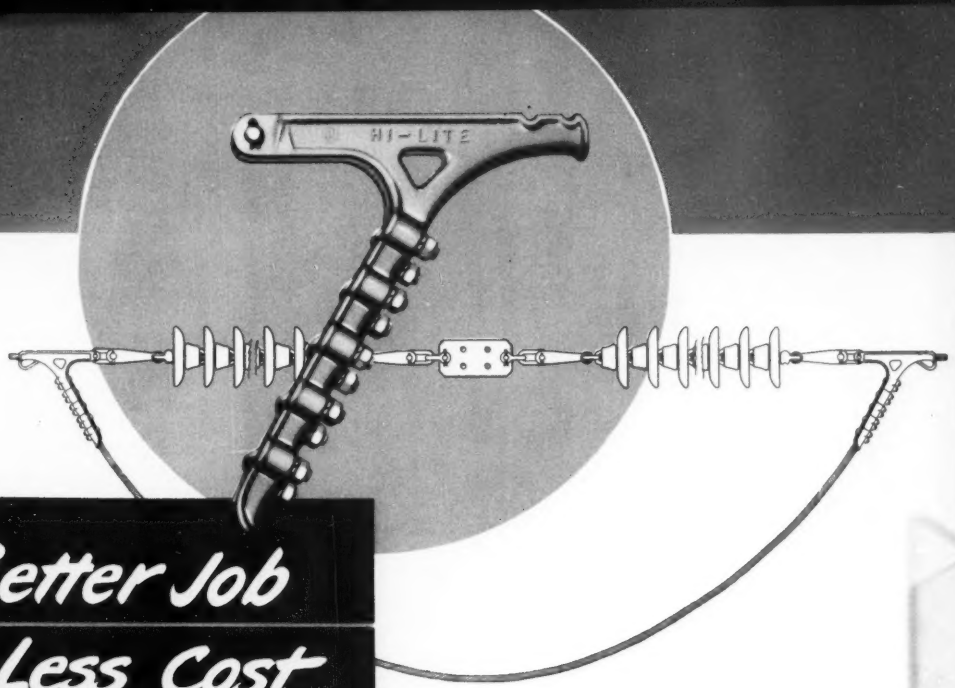
gives maximum protection

All you will ever get from a lightning arrester is apparatus protection--the more the better! This protective performance is measured clearly. It exists between the *actual* impulse insulation strength of station equipment and the average published sparkover and IR discharge values of the arrester, minus--and this is important--*minus* arrester tolerances. These tolerances are deducted from protective margins; it's the only place they can come from . . . O-B Thorex lightning arresters have guaranteed tolerances of less than +10 per cent sparkover and less than +5 per cent IR discharge voltages. These are the lowest ever offered on the American market. For maximum protection, and maximum value, equip your stations with Thorex arresters.

A FACT... 33 YEARS OLD

Thirty-three years ago these O-B suspension insulators went into service on an Eastern property. Today, they have yet to produce a case of trouble throughout the line. . . . For obviously good reasons, the power company has continued year after year to equip new construction with O-B insulation--not on the basis of claims or conversation, but on the basis of operating *facts* obtained from their own records. . . . It is such facts that account for the bulk of O-B's popularity. Whenever you have a chance to check up, on your own terms, on the downright goodness of insulation you will get the same answer--O-B! This is the best reason for making O-B *your* CHOICE OF INSULATORS.

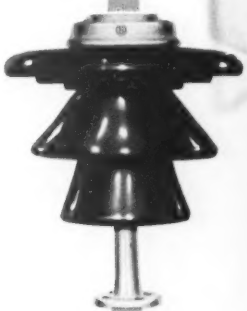




Better Job -Less Cost

Splices in transmission line jumper loops are a known source of trouble--that is unnecessary! These loops can be formed with continuous conductor by using O-B Hi-Lite strain clamps. . . . With a low first cost, these clamps require no other installation equipment than a common hand wrench, and attach to the cable in a minute or two. Full working strength of the cable is developed without slip and the grip is capable of reliable inspection throughout the life of the line. . . . You can remedy a cause of severe operating trouble and save considerable construction cost with O-B Hi-Lites. Discuss the use of these efficient strain clamps with your O-B representative.

The *CORRECT* way to figure value



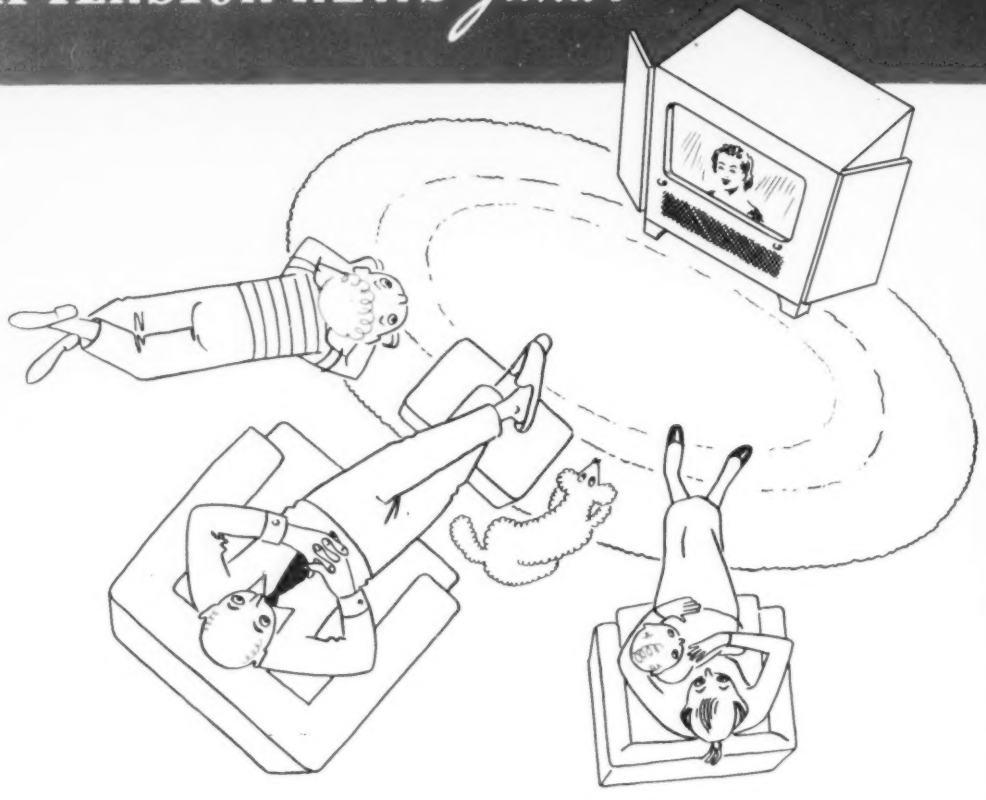
You can measure all the technical qualities of a station insulator *the first day of its life,* but not until *the last day* do you know how good it is. Performance is the one characteristic that can't be covered by standards. Yet, it's the one thing that really defines your money's worth! . . . O-B has succeeded in putting the greatest number of years between the first day and the last day, which is another way of saying we have put the greatest *value* into a station insulator. This is easily proved by the hundreds of installations that have already passed their 30th active year. . . . When you measure value correctly, in terms of time, your choice will point to O-B.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

(B)

HI-TENSION NEWS *Junior*



ALREADY A 2 BILLION KWHR LOAD

In a single year, TV jumped from one set in every ten wired homes to one in every four. During 1950, 6½ million were sold, bringing the total of installed sets to more than 10 million. Each set uses about 200 kwhr per year and takes us several steps nearer to 5000 kwhr, the average residential customer load expected by 1960.

On most primary systems, increasing power demands of TV and other electrical equipment will make the adoption of higher voltages inevitable. Why not institute a regular program of low voltage deadend replacement today? By rebuilding deadends with two O-B suspension insulators and a Universal strain clamp, your lines will be ready for any voltage selected--up to and including 12.5 kv.

Build Primary Deadends for Higher Voltage *NOW!* and Be Ready for Tomorrow's Increased Loads

Ohio Brass

MANSFIELD • OHIO 4123-1

Locating Ground Faults

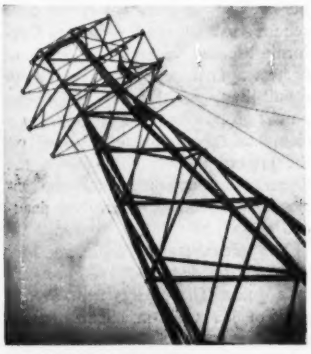
(*Continued from page* 136)

group, the test equipment is moved to the group circuit and the procedure repeated. The trouble can usually be traced to a branch circuit serving a single motor.

This fault-location method supplements the customary methods of handling ground faults: As soon as a ground alarm is received, all *non-essential* circuits are disconnected in succession and temporarily to ascertain if one is faulty. If this process of elimination indicates that the fault is on some *essential* auxiliary circuit, the clip-on ammeter testing scheme outlined is used. However, if local conditions indicate that too much time will be taken to use this test, it may be better to disconnect the essential auxiliaries in succession and temporarily, even though this procedure takes the main generating unit out of service. Where the ground fault exists on a bus or incoming connection, the buses will have to be successively isolated to locate the fault.

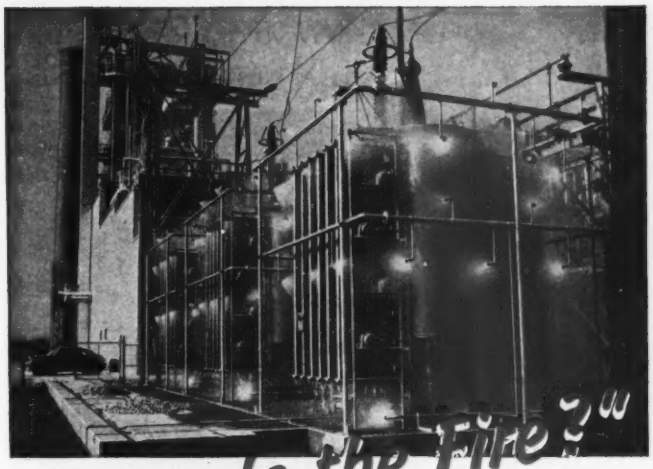
Since the clip-on ammeter test has been used here only since the fall of 1949, more definite conclusions cannot be given until further experience has been gained.

No Painting Shut-Downs With Aluminum Crossarms



ALUMINUM CROSSARMS of non-corrosive qualities not only do away with shutdowns when painting them—their lightness makes for easier installation

First known installation of aluminum crossarms has been made on a Duquesne Light Co 66-kv line to eliminate shut-downs while crossarms are being painted. The aluminum cross-



"Where's the Fire?"

OUT—ALMOST BEFORE IT STARTED—
THANKS TO THE SPLIT-SECOND ACTION OF A
BLAW-KNOX FOG SYSTEM

These Blaw-Knox Fire Protection Systems carry the approval of all insurance underwriters:

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

"LITTLE JOEY SPRINKLER"

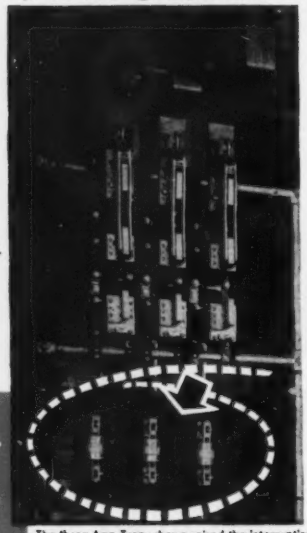
The instant fire breaks out in any transformer—indoors or out—the Blaw-Knox rate-of-rise thermostat sounds the alarm and throws a dense, quenching fog of water on the danger spot. Instant application of fog extinguishes the fire and protects adjacent transformers and equipment. The remainder of the bank is back in service in short order. Blaw-Knox Fog Nozzles have no screens to clog, use raw water and maintain their effective spray pattern even at reduced pressures.

At your request a Blaw-Knox Engineer will make a survey of your fire hazards, prepare a preliminary layout of a system that will give you the utmost in fire protection, and submit an estimate of costs—all without obligation.

BLAW-KNOX SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
829 Beaver Ave., N. S., Pittsburgh 12, Pa.
Offices in Principal Cities

BLAW-KNOX FIRE PROTECTION SYSTEMS

how to trap amperes and save circuits....



The three Amp-Traps shown raised the interrupting capacity of this 1600 amp circuit to 100,000 rms amperes @ 440 volts.

SHAWMUT Amp-trap*

AMAZING NEW CURRENT LIMITER

100,000 rms AMPERES INTERRUPTING CAPACITY

TWO-WAY PROTECTION

Amp-trap protects against *both* overloads and shorts on circuits up to 600V AC or DC. It is supplied in all standard ratings from 1 to 4,000 amps, and limits short circuit current on circuits where the available short circuit current may be as high as 200,000 amps.

STOPS SHORT CIRCUITS SHORT

Amp-trap puts a dependable new protective device in the hands of designers, engineers and architects. Lightning fast, it is directly responsive to the *rate of short circuit current rise.* In fact, *it is as fast as the circuit is fast.* This means positive overload and short circuit protection for switchgear, bussducts, motor starters, circuit breakers, and current transformers. What's more, with Amp-trap, you can now have low-cost protection for every service entrance on a network system.

APPROVALS

Amp-trap is listed by Underwriters Laboratories. Interrupting tests up to 202,000 amps at 500 Volts 60 cycles have been witnessed and certified by Electrical Testing Laboratories, Inc.

FOR OLD OR NEW SYSTEMS

There is an Amp-trap for every application. They are easily installed and quickly adapted to new or old equipment. Cost is so low that it is not an important factor.

WRITE TODAY. SEND FOR FREE BOOKLET ON AMP-TRAP.

*Trade Mark Registered.

(You can get Amp-trap)

THE CHASE-SHAWMUT CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

arms were used on the entire 21 towers of the line between Phillips Power Station and North Substation.

An alloy possessing excellent resistance to corrosion, and requiring no surface protection, was used. Approximately 24,000 lb of aluminum structural angles were installed. They ranged in size from 2½x2½x⅜ in. to 6x6x⅝ in.

Guide Protects Bull Line, Speeds Deadend Changing

ROPE GUIDE made from channel iron and split pipe protects the bull line when it is passing over a crossarm

R. U. COX
Line Foreman
California Electric Power Co
Riverside, Calif.

A simple horseshoe-shaped rope guide, spot-welded on a channel which fits over a crossarm, halves the time required to change out deadends. California Electric developed the guide to protect against mechanical damage to a bull line passing from a niggerhead on the ground over the crossarm to a clamp on the conductor. A man on the ground handles the line on the niggerhead, controlling exactly the tension that is required to free the deadend.

The guide is made of a piece of 2-in. pipe split, opened and flared out to act as a guide. The pipe is bent over a piece of 3½ x 6¾-in. channel longer than the vertical dimension of the crossarm, so it forms a horseshoe-shaped guide which will protect the rope at all angles from vertical to horizontal.

In addition to greater ease and speed, this method is safer than using a coffing hoist, because the danger of getting the metal chain into hot circuits is eliminated.

Crapo
GALVANIZED STEEL
STRAND

Combines All Four

EVERY requisite that sound construction needs demand are combined in *Crapo* Galvanized Steel Strand—

1. High strength
2. Ruggedness
3. Long life
4. Economy

The superior tensile strength inherent in steel is utilized to fullest advantage in each size and grade of this time-proved strand. The heavy, ductile, tightly-adherent galvanized coating—applied by the famous *Crapo* process—provides dependable protection to the steel, extends the life of the strand beyond the normal period of replacement.

Specify *Crapo* Galvanized Steel Strand for guys, messenger and overhead ground wires! There is a size and grade for every practical need available for prompt shipment.

ASK YOUR JOBBER!

Consult your nearest distributor of *Crapo* Products or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE INDIANA

Announcement!!

Guth is coming out with a new line of fixtures for Industrial applications:

LIGHTING FOR PRODUCTION

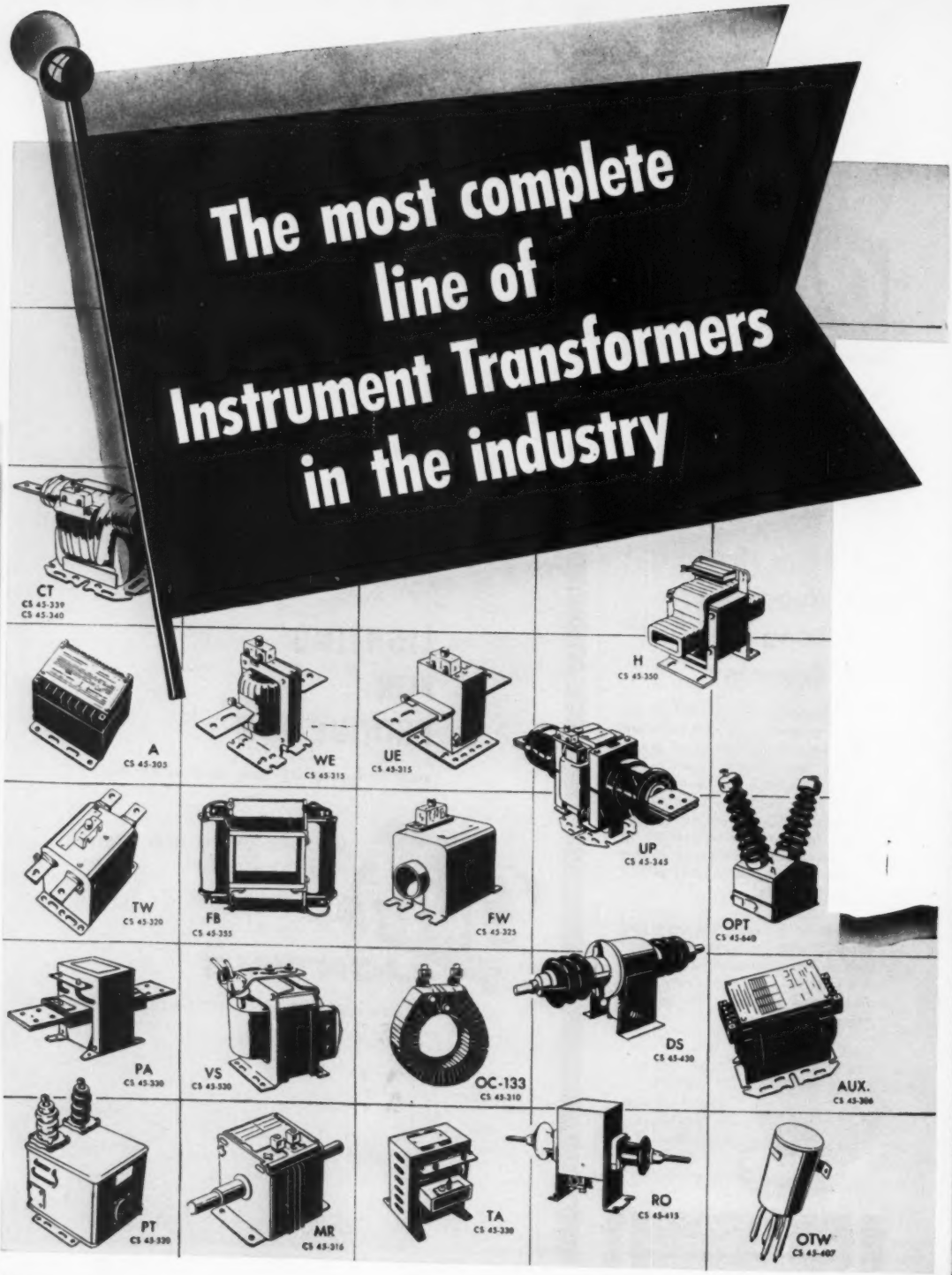
something really new and different!

WAIT FOR DETAILS NEXT MONTH
HOLD YOUR ORDERS

Guth LIGHTING

THE EDWIN F. GUTH COMPANY • ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902


The most complete line of Instrument Transformers in the industry
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TA
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RO
CS 45-415
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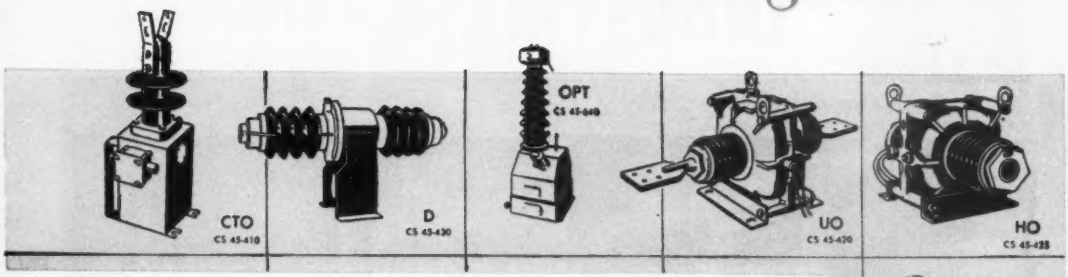
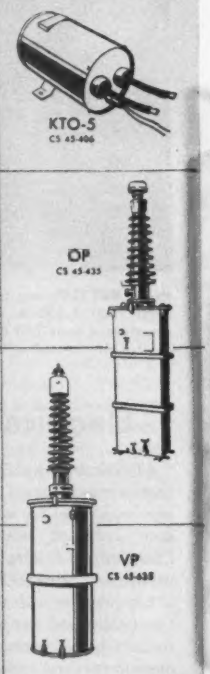
YOU CAN BE **SURE**.. IF IT'S

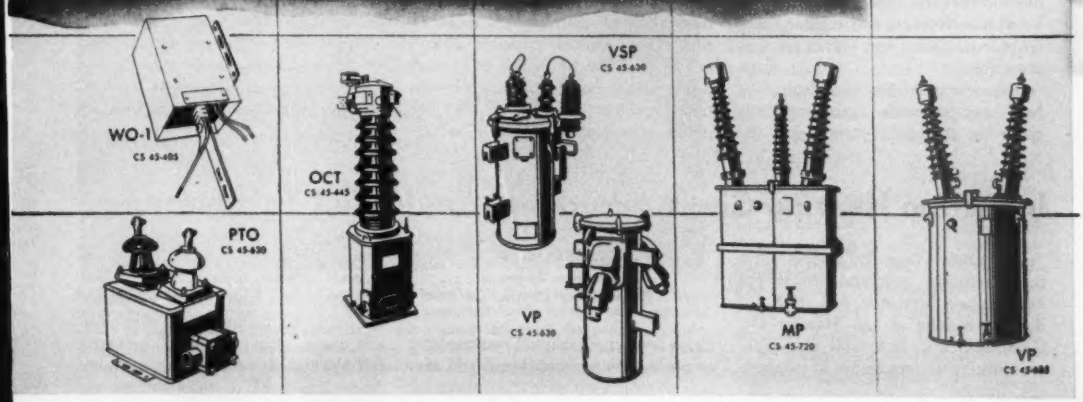
Westinghouse



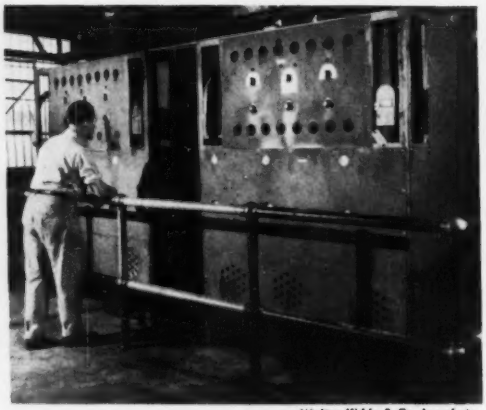
Solve all your instrument transformer problems quickly, easily! Turn to the Westinghouse salesman. He has the most complete line in the industry . . . for metering, relaying, current, potential or auxiliary applications. For further information on any of the transformers illustrated, contact your nearest Westinghouse office, or write for Catalog Sections by listing the "CS" numbers desired. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70573

Westinghouse
INSTRUMENT TRANSFORMERS





WAX KETTLES are surrounded with jacketed piping. Each kettle has 1,500-lb wax capacity. Melting temperature is maintained near 250 F. Positive displacement pumps circulate electrically heated oil through kettle jackets



Walter Kidde & Co, Inc photos

ELECTRIC HEATING UNITS replacing high pressure steam have accurate time clock control and permit flexibility in distribution of 440,000-Btu output. Each of the two heaters has three oil circulating circuits and a maximum load of 65 kw

Electrically Heated Oil Replaces Steam for Wax Melting

Electrically heated oil has replaced high-pressure steam as a source of processing heat for wax melting in the new plant of Boyle-Midway, Inc, Cranford, N. J. The new system saves man-hours, provides flexible high heat at low pressure with accurate temperature control and low maintenance. The former high-pressure steam heating method required expensive equipment, a full time fireman, and regular maintenance of piping and valves for leak prevention.

The new plant has two electric oil heat transfer units occupying little space on the main plant floor, the units work in tandem to heat the six melting kettles located on a mezzanine floor directly above. Each kettle has a 1,500-lb wax capacity and the melting temperature is maintained near 250 F.

The new system can supply heat up to 550 F where necessary, at negligible vapor pressure, and can be used with inexpensive distribution equipment of comparatively light construction. The heaters circulate electrically heated oil by means of positive displacement pumps from a self-contained cabinet through the jacketed piping surrounding the wax kettles.

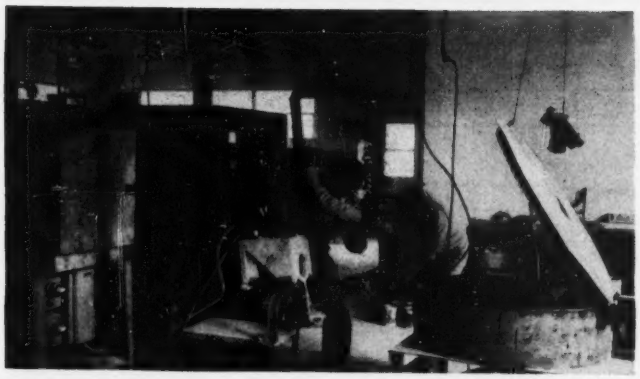
Each of the two units has three oil circulating circuits and operates at a maximum load of 65 kw. Each has a master time clock device that starts and stops the heat transfer system at predetermined intervals. Separate time clock regulator is on each wax kettle. (Thermostatic control can be used instead of time cycle regulation.)

Connected in series, the heater units are arranged for maximum flexibility. The full heat output of 440,000 Btu per hr can be channeled to one or two kettles for quick melting, or the heat can be distributed evenly among all six kettles.

Induction Heating Gives Accurately Controlled Temperatures

L. ALBERTSON
Application Engineer
Philadelphia Electric Co

Accurately controlled temperatures for producing precision investment castings are furnished with H-F induction heating at the Harcast Co, Glenolden, Pa. Industrial parts that are difficult or impossible to machine are "natural" applications for the precision investment method because little or no machining is required, and savings in tooling-up time often reach 80 to 90%. Parts for general industries, aircraft engines, ordnance, instrument manufacturers, and textile machinery are produced in clusters and with close tolerances from molds prepared through the use of hot wax. A 20-kw furnace is used to melt the metals



ELECTRIC FURNACES provide accurately controlled temperatures for precision casting, a method of producing industrial parts which often cuts tooling-up time 80 to 90%. At left is 8-kw furnace for melting out low temperature wax molds from investments and for high temperature preheating prior to castings. At center is 20-kw H-F generator for melting metals in crucible

which are often high temperature alloys requiring temperatures above 2,000 F. An 8-kw furnace preheats the molds and melts out the low temperature wax. Molten metal is poured from crucible to portable container and transferred to centrifugal machine where rotation forces molten metal into investment molds to complete casting of a cluster of objects or a single one. This method is ideal for short runs to several thousand parts.

Color Contrast Aids Safety

PAINTING MACHINERY PARTS and control handles in light but contrasting colors calls attention to danger areas and makes the materials being fabricated or repaired easier to see—thus adding materially to the overall safety of the shop operation. Some industrial plants have followed this practice for years with great success. American Airlines' La Guardia Field Shops have also found this practice an important safety feature. All mobile equipment is painted international orange

INDUSTRIAL BRIEFS

Mechanical Loading and adding a new remotely controlled 16-ft hydrapulper with motorized valves and auxiliary pumps permitted a fine paper mill to release nine men for other work, and provided a wider safety factor for preparing stock for future expansion of the paper machine. Batches can now be pulped at 6% consistency containing 4,500 lb of air dried stock in 25 min. Current required at beginning of cycle is 250 amp, dropping sharply to 190 amp and then to 160 amp during last half of pulping cycle. Maintenance is negligible compared with old installation. Formerly batches were pulped at 5½% consistency containing 3,000 lb of air dried pulp in 45 min with 300-amp power requirement.—G. B. Gregg, power engineer, Cincinnati Gas & Electric Co.

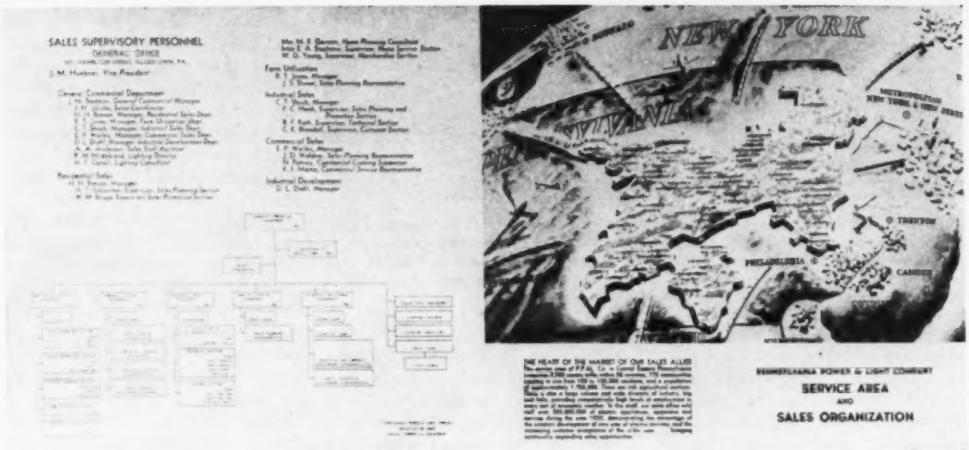
Factory Lighting of more than 70 ft-c of shadowless illumination on working surfaces in assembly and machine room of Benrus Watch Co, Inc, Waterbury, Conn., is secured by standard two-light fluorescent fixtures mounted 36 in. above ables. For fine inspection, 100 ft-c is provided by 24-in. mounting above tables. Combinations of standard 40-w daylight and cool white lamps give a color pleasing to operators.—Connecticut Light & Power Co.

Milling Operation at the plant of Judson Steel Corp, Oakland, Cal., was speeded by a stepless adjustable speed motor in providing the many different exact speeds required to mill deformations on rolls used in a corrugating machine for processing concrete reinforcing bars. Adjustments in speed required are made quickly and accurately by a twist of the knob on top the motor which is rated at 5/1.67 hp, 2,500/833 rpm, 440 v.—General Electric Co.

Plywood Bonding by application of a 2-kw, 13.6-megacycle RF generator to a press makes it possible to bond three pieces of plywood into a chime clock case in 90 sec. Previously used animal glues, air dried in a large rotating rack, required a minimum setting time of 4 hr under ideal conditions.—Westinghouse Electric Corp.

SALES AND SERVICE

RESIDENTIAL • RURAL COMMERCIAL



"WHO'S WHO" in PP&L sales organization tells local trade whom to contact for what

Improve Cooperation by Better Acquaintance

Close cooperation with the local electrical trade is fundamental to the sales promotion activities of the Pennsylvania Power & Light Co. All of the company's programs are designed with such cooperation as a major component and ideas for increasing it are constantly sought.

Latest of these is an 8-page pull-out folder which details the company's sales organization. As the illustration shows, the front of the folder carries a map of the company's service area with principal communities spotted and a short paragraph describing the area in terms indicating its electric appliance and equipment sales potential.

The back of the folder shows the general office sales supervisory organization in chart form with names of personnel. Inside is another chart of divisional organization plus the names of personnel in the division offices.

The purpose of the folder is to give to dealers, contractors, distributors, and others concerned with the sale, installation and servicing of utilization equipment a convenient means for knowing whom to reach in the company in reference to any sales or associated matter. Also the names of individuals with their positions in the company facilitates the personal acquaintance with them which is the basis of true cooperation. To each member of the trade in the company territory 5 copies of the folder have been mailed, with an offer of more if desired.

How Traffic Counts Can Build Lighting Usage

JOHN D. HAVERKAMP
Supervisor, Industrial & Commercial Div
New Orleans Public Service, Inc

An old but little practiced method for increasing commercial show window and sign lighting usage by traffic counts produced additional estimated annual revenue of $2,079 in a six weeks experiment by New Orleans Public Service, Inc. No investment was required by the utility and the only customer investment was for an occasional time clock to control the lights.

A total of 95 traffic counts were made with the following results up to January 15, 1951: 37 customers or 39% increased their usage; 23 customers or 24% were considering following our recommendations; and 35 customers or 37% took no action but did listen while we presented our story.

During December 1950 we experimented with an old method of selling increased hours of lighting usage with the above-stated remarkable results. While the method used is an old one it has not been practiced to a large extent since before the last war. Probably some of the younger utility lighting salesmen never

SIMPLEX-ANHYDREX CABLES STAY ON THE JOB IN WET LOCATIONS

Here's Proof

IN TEST FIGURES

Continuous testing to rigid standards proves without doubt that Anhydrex insulation will not absorb more than 20 mg. of water per square inch of exposed surface. Rarely does the figure climb that high. After one day's immersion in water at 70°C. (158°F.) Anhydrex has a dielectric constant that will not exceed 3.2. Its increase in capacitance between one and eight days' immersion at 70°C. will not exceed 3.5% for insulation thicknesses greater than 4/64", or 5% for thicknesses of 4/64" and less.

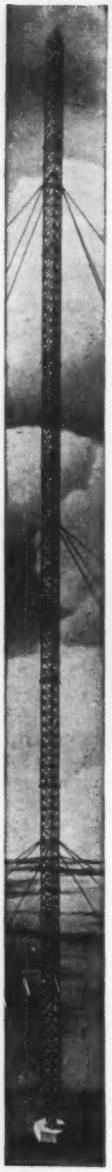
IN SERVICE RECORDS

Reports from the field, which indicate that no ANHYDREX Cable has ever failed due to water absorption, include this account: An eastern city known for its bad water conditions installed nearly 10,000 ft. of ANHYDREX Cable in its municipal signal and communications systems. During ten years' service the cables had no trouble whatsoever, although ducts and manholes there are nearly always full of water and metallic cables used in the same installations had proved inadequate. ANHYDREX Cable that was buried directly in the ground came through with the same trouble-free service, and portions of cables exposed above earth suffered no deterioration.

Neoprene-jacketed ANHYDREX Cables need no additional coverings. They cut down weight, diameter and cost. You can use them underground, overhead, or in ducts without fear of water and moisture, soil acids and alkalies and weathering. Specify them with confidence for transmission and distribution systems, signal and communication circuits, street, airport and park lighting.

SIMPLEX ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

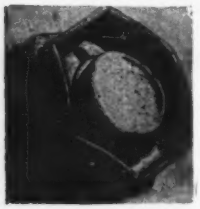


Truscon equips world's tallest radio tower *with*

PALNUT
TRADEMARK

LOCK NUTS

This new 1212-foot Truscon Radio Tower, tallest ground-supported tower ever built, incorporates many advanced engineering specifications. But one important specification remains unchanged . . . the use of PALNUT Lock Nuts . . . continuing a 15-year standardization by the Truscon Steel Company, Youngstown, Ohio for all its towers.



- Prevents loosening of regular nut and bolt.
- Eliminates checking and retightening of bolts.

FOR years PALNUT Lock Nuts have been standard equipment on towers built for AM, FM, TV, Signal Corps, power transmission, etc. Low in cost, easily applied on top of regular nuts. PALNUTS provide absolute assurance against loosening of bolted assemblies. No further maintenance is required. PALNUTS have proved superior to lockwashers or prick punching.

Specify PALNUTS for your towers. Available in a wide range of sizes, hot dip galvanized for weather resistance. Ask for samples and literature.

The PALNUT Co.

TRAFFIC COUNTS of pedestrians, automobiles and public vehicles were made by utility sales representatives using mechanical counters. In a six weeks experiment, 95 traffic counts resulted in $2,079 estimated annual revenue from 37 customers

have used it. We know that some of our lighting salesmen had not used it until our recent activity.

The method used was the presentation of traffic count data secured from the customer's own location. Our sales representatives determined by their own inspection the approximate time that certain selected customers turned off their window and sign lighting. Then either at the same time or on a succeeding night, a traffic count was made.

The traffic count covered a period of at least one hour and consisted of:

1. The number of pedestrians passing.
2. The number of automobiles passing.
3. The number of public vehicles—street cars and busses—passing.

For accuracy mechanical counters were used, two of which can easily be handled by one man. The best hours for making the traffic counts were found to be between 8:00 to 11:00 pm and several can be made per night, allowing one hour for each location.

The next day a report was prepared for the customer for each location where traffic was counted the preceeding night. The report started with a paragraph stating the advantages of attracting prospective buyers with a well lighted show window or sign. Then a short statement to the effect that the customer was not realizing the best return from his lighting investment because of turning out his lights while prospects still were passing by.

Then followed the traffic count data proving that prospects were actually passing but not being attracted by a darkened show window or sign. A paragraph was included in each report stating the connected watts of lighting and exactly how much additional *per hour* it would cost to burn these particular lights.

The report closed with a specific recommendation for additional time of burning such as from 8:00 pm to midnight or whatever other hours seemed desirable for the specific location. The additional cost per night or per month was clearly stated based on the recommended increased hours of usage.

The increased costs of operation in all cases were low because of the low incremental cost per kwhr for such usage and because in most cases no additional demand charges were involved.

The report was presented the next day to the customer. In practically all cases the customer knew nothing of the traffic count or report until he saw it at this time.

During the experiment as a means of encouraging our salesmen in this type of activity we offered a small bonus for each traffic count.

We plan to increase our efforts

"So Easy, even a girl can assemble it"

says Millie Seelhorst,
Pole Star Core Assembler

Miss Mildred Seelhorst, who works on the Pole Star Core Assembly Line, illustrates the ease with which the lapped core can be built into the coils of a Pennsylvania Pole Star Transformer.

The relative simplicity of this operation emphasizes an important feature of the Pole Star core:

In the event a coil is damaged by lightning or excessive overloading, the entire core and coil unit does not have to be scrapped — most of it can be used again, because the core can be taken apart and quickly rebuilt with replacement coils *without appreciably affecting the low core loss or exciting current of the Pole Star.*

This functional design feature of the Pole Star Core assumes added significance during the present period of national emergency, when it is necessary to conserve copper and steel wherever possible.

Pole Star Transformers are available in sizes 3 KVA through 100 KVA, 2400 through 14,400 Volts.

Laminations from center of core are inserted into the coils, brought through, and individually lapped. No special tools are needed, and the annealed steel is not bent beyond its elastic limits.

Each individual lamination forms its own magnetic path — is actually a core itself. Since there are no gaps or butt joints in the core, no mechanical clamping device is required to hold the core together.

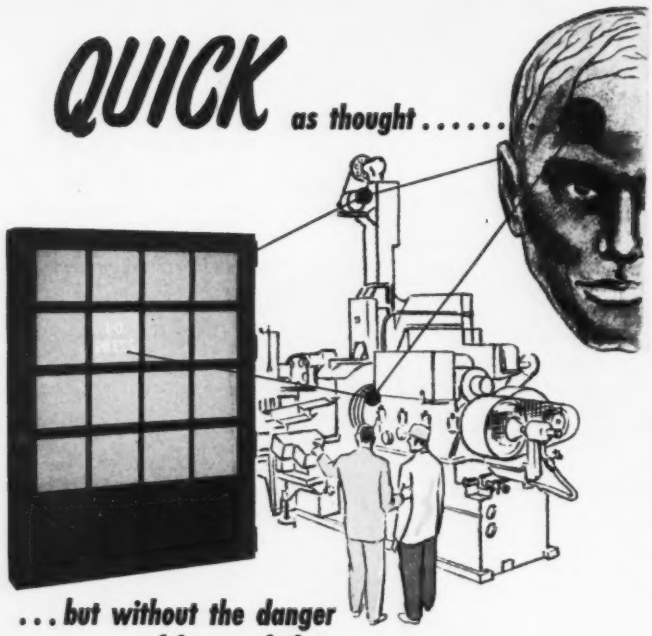
The last lamination is taped, then brazed, and the unit is complete. The amount of contact pressure between laminations is not important; therefore the noise level in the core will be at a low level and will not change.

P.S. Let the POLE STAR be your guide

Product Of Long Experience
Safe Thrifty And Reliable

Pennsylvania TRANSFORMER COMPANY

Canonsburg, Pennsylvania - Greater Pittsburgh District



AUTH

SUPERVISORY ANNUNCIATORS
provide audible and visible signals that

- ***PROTECT YOUR EQUIPMENT***
- ***SPEED YOUR PROCESS***
- ***SAVE YOUR PRODUCT***

Dependable AUTH equipment prevents costly breakdown of vital services or expensive equipment by giving insistent visible and audible alarms of such conditions as overheated bearings, low fuel level, high cooling-water temperature, low or high pressure, end of a processing cycle, etc.

AUTH SUPERVISORY ANNUNCIATORS work this way:

when trouble occurs, a supervisory annunciator receives an electrical impulse from a normally open or normally closed, momentary or maintaining contactor, such as a thermostat, pressure or float switch. This impulse is converted in the annunciator circuit to a maintaining circuit that operates a visible signal indicating the source of trouble, and simultaneously sounds an audible alarm. Various operations sequences are available.

Write today for complete descriptive literature, without obligation!

SINCE 1892 AUTH

COMPLETE SYSTEMS • ONE RESPONSIBILITY

AUTH ELECTRIC COMPANY, INC.
34-20 45th St., Long Island City 1, N.Y.

MANUFACTURERS OF: Electrical Signaling, Communication and Protective Equipment for Housing, Hospitals, Schools, Offices, Ships, and Industry.

along this line because of the unusually high customer and utility company benefits. It would appear worthwhile for other utilities to consider similar activities.

Dealers Profit from Lamp Modernization Campaign

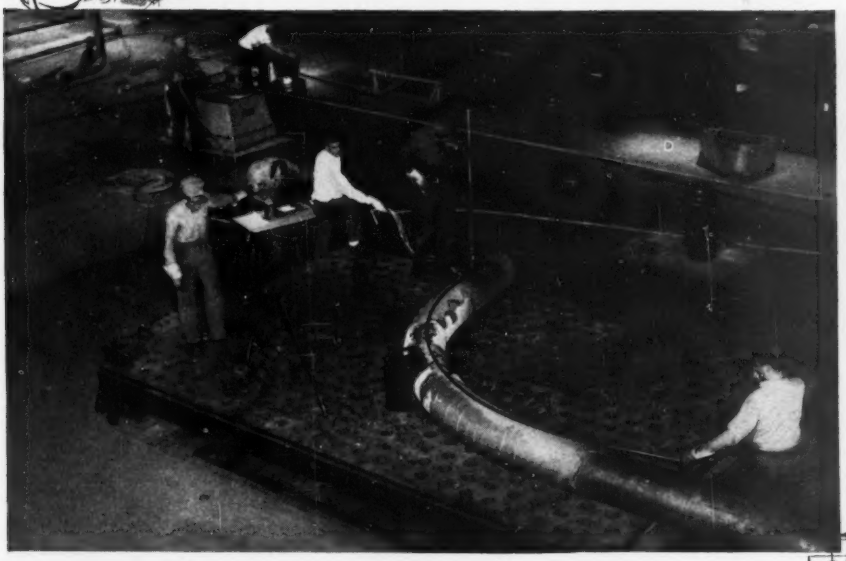
Retailers of lamp bulbs in the service area of the Pennsylvania Power & Light Co are profiting from a portable lamp modernization promotion of the company. Under the slogan, "Improv-a-Lite for Better Sight" the promotion runs from March 12 to April 28. During the period the company is running weekly advertisements of 15 and 30 column-inches in 35 daily and 42 weekly newspapers. The merchandise featured is the Monowatt lamp wiring kit with GE three-light 50- 100- 150-w indirect lamp bulb. Along with the ads, PP&L set up displays on their own sales floors and show rooms.

The announcement to dealers listed names of local distributors from whom the lamps and wiring kits could be obtained. Included with it was a sketch of a suggested counter display. Dealers were urged to tie in their own advertising with that of the company which tells the reader to "See Your Lighting Equipment Retailer."

Ads Tell the Customers Power Industry is Prepared

ELECTRICITY supply adequate for defense preparation requirements is the theme of this series of advertisements recently used by the Northern States Power Co. Emphasis is centered on the post-war accomplishment of the business-managed power companies in doubling their capacity over ten years ago

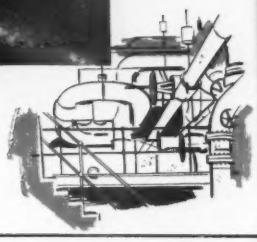
From interpretation to installation . . .



GRINNELL PREFABRICATED PIPING

assures greater customer satisfaction through its five-point program of

Quality Control



The bending operation illustrated above is an example of Grinnell QUALITY CONTROL *in action* . . .

The tubing shown is made from a chromium alloy steel forging, turned and bored. Outside diameter is 14¾ inches; wall thickness 2⅜ inches. Temperatures of the tubing within the bending furnace were maintained and controlled within 20°F of specified temperatures. Bending was done with such skill and rapidity as to permit a temperature drop of only 100°F at the inside surface of the tubing. Maximum thinning was only .06 inch.

Designed for a central station power plant to accommodate 1500 PSI and 1050°F, this is typical of Grinnell's engineering knowledge which assures prefabricated piping of the right kind — for all types of installations no matter how complex.

QUALITY CONTROL is the result of Grinnell's 100 years of practical experience in the field of piping. Delivery of prefabricated piping subassemblies to exacting engineering requirements which meet all governing code requirements is assured by Grinnell Quality Control, which includes:

- Interpretative engineering
- Metallurgical research
- Specialized facilities
- Skilled personnel
- Rigid inspection

ECONOMY of specifying Grinnell prefabricating piping results from:

- One source for design, interpretation and fabrication
- Coordination of shop production under ideal conditions
- Elimination of waste by paying only for finished material delivered
- Reduction in field erection time

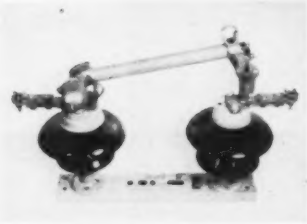
Write for the booklet, Grinnell Prefabricated Piping.

GRINNELL

WHENEVER PIPING IS INVOLVED

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

NEW EQUIPMENT



Interchangeable Fuse Tubes

By changing or replacing the fuse tube assembly, eight combinations of continuous current and interrupting capacities are possible in each kv rating. Classified LB, MB, and HB, the fuses are available in ratings of 7.5, 15, 23, 34.5, 46, and 69 kv. Another feature of this fuse line is a completely housed snubber that brings the opening tube assembly to a cushioned, shock-free stop.

Southern States Equipment Corp, Hampton, Ga.

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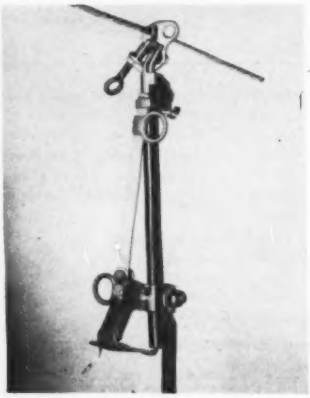


Temporary Load Switch

A temporary load break, load pick-up switch provides a simple means for removing taps from conductors under load conditions where there are no reclosers or circuit breakers. Manufacturer states that conductors or clamps are not pitted or burned, and that long arcs are not drawn.

Cutouts may be opened safely on loaded circuits by jumping around them, with the load switch jumper, to by-pass the circuit while cutout is opened manually—then breaking the circuit by pulling the switch blade.

A disconnect switch and flexible link connection are combined in this switch. After the switch blade is pulled, the link connection is broken by tripping a trigger to release the link intact.

A. B. Chance Co, Centralia, Mo.

•

Electric Power Drive

Power drive equipment has been introduced which consists of a totally-enclosed fan-cooled geared-head motor with motor-mounted brake. The brake can be supplied for either stopping or holding service. Both motor and brake are dust-tight.

Ratings range from 2 to 15 hp, and AGMA speeds from 280 rpm to 30 rpm.

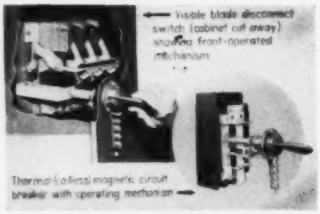
Sterling Electric Motors, Inc, Telegraph Rd at Atlantic Blvd, Los Angeles 22, Cal.

•

Operating Mechanism

Designed for convenient mounting, this operating mechanism permits the disconnect (either switch or breaker) to be mounted directly on the panel without use of posts or brackets. The mechanism is reported to meet requirements of manufacturers who assemble their own control panels for machine tools or other electrically-operated equipment.

A coupling rod from the disconnect engages the separate operating handle assembly mounted on the door.


Visible blade disconnect switch (cabinet cut away) showing front-operated mechanism
Thermal-I-alloy magnetic circuit breaker with operating mechanism

Changes in the length of the coupling rod accommodate switches mounted in cabinets of varying depth: 6⅜ in. to 14 in. from door to panel surface; or with breakers in cabinets 6⅜ in. to 13⅛ in. from door to panel.

Switch design includes visible blades, dead-front construction, positive pressure fuse clips, and silver-plated current-carrying parts. Details are in Bulletin 2420-FG.

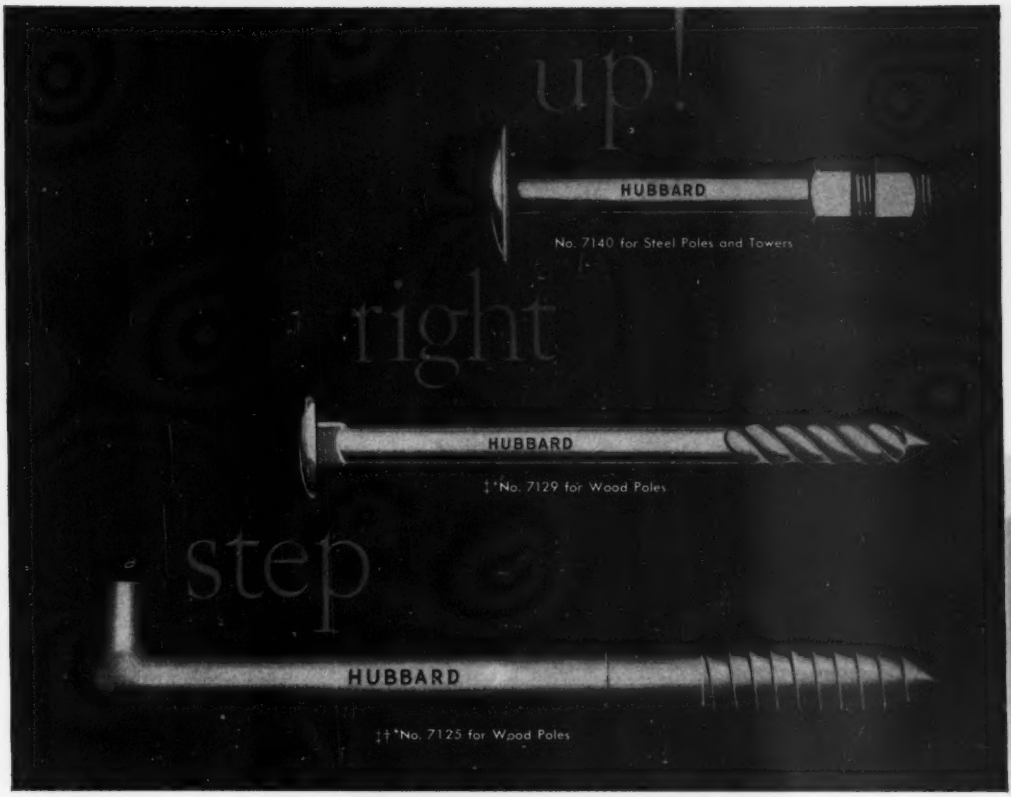
Square D Co, 4041 N. Richards St, Milwaukee 12, Wis.

•

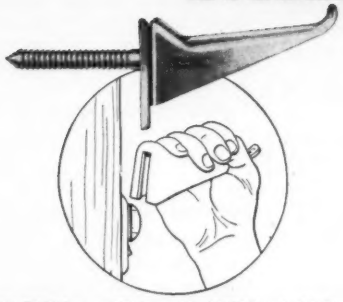
Control Centers

Designed to accommodate control systems up to 600 v, the Multitrol control centers use no components larger than NEMA Size 5. Primary applications are for generating plant auxiliaries, industrial plant machinery, and other installations where a group of motors can be controlled from a central location.

Multitrol is available with mag-



HUBBARD POLE STEPS...



No. 7235 Lag and Plate and No. 7236 Detachable Step are designed to prevent unlicensed climbing. The plate is slipped over the head of the lag and is prevented from turning by a lug in the lower part of the plate.
‡A.A.R. Std. *Western Union Std. †E.E.I. Std.

DESIGNED FOR SAFETY

Hubbard Pole Steps are designed to carry the heaviest human load and to withstand all normal conditions in use, with an ample safety reserve. They are forged from new Open Hearth Steel and bend tests are made periodically, after galvanizing, to check malleability and freedom from embrittlement. All Hook Head Steps have fetter drive threads and marking rings, which indicate proper installation depth and provide a tight seal against water seepage. See Hubbard Catalog No. 50, page 42, for the full line of Hubbard Steps for wood and metal poles, towers and concrete poles.

HUBBARD AND COMPANY
ESTABLISHED 1882
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA
"Hang the Load on Hubbard Hardware!"

201-NE Plier

5233 Klein-Kord Safety Strap

5249 Klein-Line Tool Belt

1901-M Climber

1628-3BH Klein Chicago Grip

When it comes to equipment on which life depends—safety straps and belts, climbers and grips, pliers and tools—there can be no compromise with quality.

Nearly a century of experience is back of Klein equipment for linemen and electricians. Today the name Klein is recognized for highest quality wherever such equipment is used. When life is at stake, only *the best* is *good enough.* In tools and equipment, this best is Kleins—"since 1857."

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

If you have not received your copy of the Klein Pocket Tool Guide, write for one. It will be sent to you without obligation.

Since 1857

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

3200 BELMONT AVENUE CHICAGO 18 ILLINOIS

netic full-voltage starters, reversing or non-reversing; multi-speed starters; primary or secondary resistance starters and autotransformer starters. Standard starters are equipped with externally-operated circuit breakers, thermal overload protection, and low-voltage protection.

Prefab units, containing control for a single motor, are wired into a free-standing steel enclosure section. Any number of sections may then be bolted and bussed together.

Ward Leonard Electric Co, 115 MacQuesten Parkway South, Mount Vernon, N. Y.

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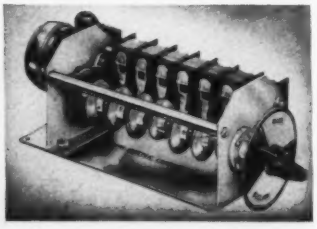


Multi-Circuit Cycle Timer

Timing the operation of industrial furnaces, electrical appliances, and solving laboratory timing problems are purposes of the multiple-circuit cycle timer. It may be set for on and off periods with as many circuits as desired, manufacturer states. It can be furnished without synchronous motor for elevator control, limit switch, and similar applications. Additional details may be found in Bulletin 142.

Zenith Electric Co, 152 W. Walton St, Chicago 10, Ill.

•

Vertical Cable Support

A new type of vertical cable support is intended to provide for an extension of rigid conduit or flexible conduit. A typical installation would support the cables as they rise

Correction

Address of Tensor Electric Development Co, Inc, manufacturers of the oscilloscope calibrator described in the April 9 issue, was incorrect. Proper address is 343 Classon Ave, Brooklyn 5, N. Y.

YOU CAN DO A LOT WITH A LITTLE JENKINS

See for yourself . . . there's more tape value in every roll of Gold Seal. It's always "tacky" — never dries out, peels or ravels — gives you a tighter, better bond because each fiber of quality base cloth is thoroughly impregnated. Easier to handle, too. Gold Seal Tape always tears evenly, quickly. High dielectric strength . . . just one thickness insulates. Ask your supplier for Gold Seal Tape now. Jenkins Bros. (Rubber Div.), 100 Park Avenue, New York 17.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal specifications.

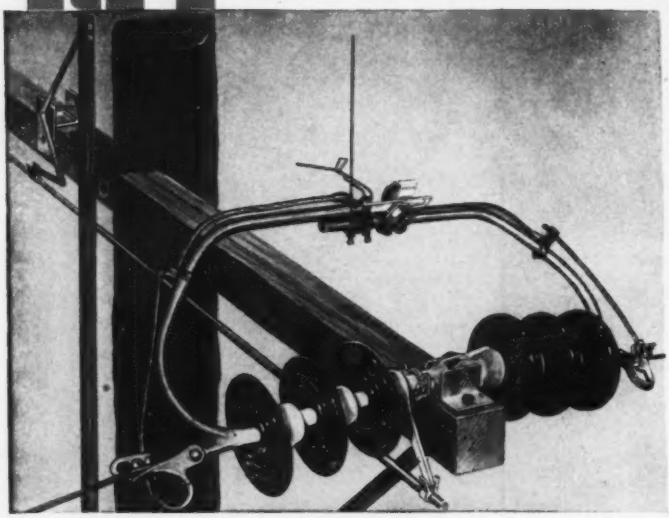
Gold Seal Tape

FRICTION and RUBBER TAPES

In either 10-roll cartons or single rolls. Every roll cellophane-wrapped.

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

KPF POLE TOP SWITCHES



Simple design means more switch ...for less money!

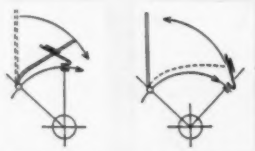
KPF Pole Top Switches cost less because they are simplest in design. They lower installation costs because they bolt on a single crossarm in minutes, require no extra insulators. KPF switches save, too, on upkeep; simple push-pull interphase rods never bind because of crossarm warpage; monel and bronze bearings never need lubrication.

KPF switches may be used in horizontal, vertical or triangular mounting. Free floating, self aligning blades and jaws maintain proper contact under all conditions of switch sag adjustment.

NEW QUICK-BREAK ATTACHMENT FOR KPF SWITCHES

The split-second breaking speed of these new KPF attachments means you can switch many circuits without using expensive circuit breakers. Attachment is available for all KPF switches rated 15 to 69 kv.

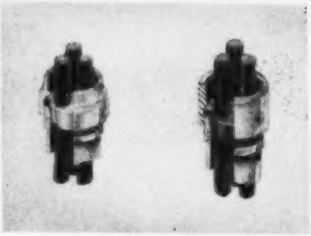
WRITE FOR DETAILS



Spring rod winds to full tension as switch opens.

Rod springs clear, breaking contact at high speed.

KPF ELECTRIC COMPANY
855 Hoviard Street • San Francisco 3, Calif.



vertically in rigid conduit, and before they are continued in flexible conduit to a large rotating machine. Design of the fitting locks the wedging inserts into position.

Type CSREF (left in illustration) is part of a series of new fittings. Type SCSR (right) enables the cables to be rigidly clamped and supported, and simultaneously provides a terminal end to be sealed with compound. Further information may be secured from Bulletin G-2-51.

The Adalet Mfg Co, 14300 Lorain Ave, Cleveland 11, Ohio

•

Airport Runway Light

High candle-power beams of light are sent out from the flattened sides of the thimble-shaped, one-piece lens of a new runway light. There is a fan of light from one of the curved sides, and a glare-free glow from the remaining curved side. A 200-w bulb is used in the unit. The unit will break free of the base if struck by a taxiing plane, due to the breakable coupling.

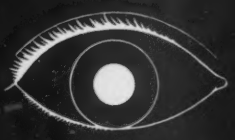
Westinghouse Electric Corp, Lighting Div, Nela Park, Cleveland, Ohio

•

Electrical Steel

An improved oriented electrical steel has been developed for use in wound transformer cores. Available

Take an Inside Look at the "One-Piece" Jaw



of a FARGO Automatic Line Splice

. . . and You'll See Why It Holds Wires Securely

Look — and you'll see why the never-out-of-alignment . . . "one-piece" jaw makes the Fargo Automatic Line Splice the sure splice . . . why it holds wires so securely . . . why it makes installations go so fast and easy. Further, it makes the Fargo Automatic Line Splice safer . . . stronger . . . and lower in overall cost.

The Fargo Automatic Line Splice is available in 5 different series to meet every requirement. Ask your Line Material Sales Engineer for complete details.

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

LM

YORK-HOOVER BODIES

SERVE

you Better

and Longer

HERE'S HOW

First, because York-Hoover Bodies are "job built." They're designed for your specific job. Second, because York-Hoover Bodies are made from the highest quality materials available. This means that when you equip your trucks with York-Hoover Bodies, both maintenance and operating costs are low . . . performance is high.

HERE'S WHY

Year after year, for over 50 years, York-Hoover customers have continued to place their confidence in our engineering and craftsmanship. To justify this confidence, York-Hoover "job built" bodies have maintained a high record of quality, performance and cost-saving efficiency. This is our contribution to the truck industry.

During the present period of National Emergency, York-Hoover's production facilities are taxed to the extent that deliveries cannot be made as quickly as normally.

We suggest that you contact us concerning your body transportation problems. We'll be glad to provide you with all the facts in detail, including earliest possible delivery dates.

York-Hoover Corporation

YORK, PENNSYLVANIA

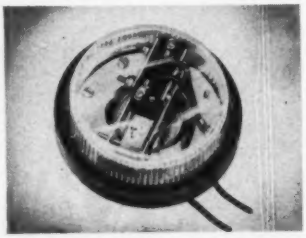
Body Division

in two grades, Tran-Cor 3W and Tran-Cor 4W, the new silicon steel reportedly has an exceptionally low core loss and high permeability. Core loss limit of 4W is 0.64 w per lb at 15 kilogauss, 60 cycles. Corresponding limit for 3W is 0.71 w per lb.

Both grades are supplied in coils one inch to 30 in. wide, and 0.012 in. thick. Since the steel comes fully annealed, a maximum temperature of 1,475 F will remove stresses produced by core winding. This steel is not recommended for stacked cores.

Armco Steel Corp, Middletown, Ohio

•



Pressure-Actuated Switch

Applications for a new low-pressure, pressure-actuated switch include: Indicating pressure drops across coils, in air filters, actuating motors on automatic air equipment, and warning against unsafe or uneconomical operating conditions in forced-air feed and boiler draft.

The slack diaghragm of this switch is linked to a beryllium copper spring with a Microswitch actuated by pressure from the spring. The switch is rated at 10 amp, 110 v ac. It can be operated on plus, minus, or differential pressures up to 4 in. water for standard models.

F. W. Dwyer Mfg Co, 317 S. Western Ave, Chicago 12, Ill.

•

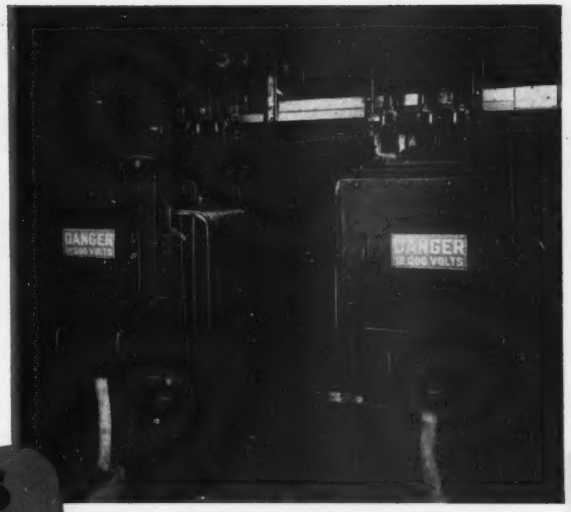
Vaportight Fixture

Eighteen types of malleable iron fixture bodies for pendant, ceiling, or bracket mounting are included in V-51 Series. These bodies are threaded to take both 100-w or 150-200-w lamp receptacle-globe-guard assemblies. All bodies except bracket types are grooved to mount 100, 150, or 200-w reflectors in a choice of four styles: Standard dome, shallow dome, deep bowl, or 30-deg angle.

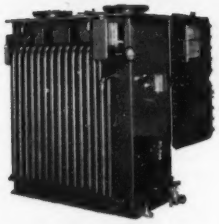
Unit assembly construction pro-

Talk to Other Engineers About

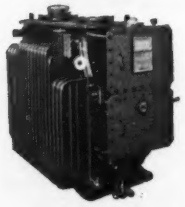
ALLIS-CHALMERS NETWORK TRANSFORMER



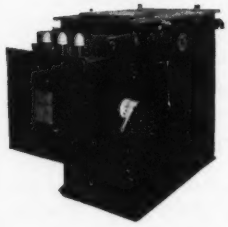
There is no finer testimonial to dependable Allis-Chalmers Network transformers than the approval of utilities and consulting firms throughout the country.



OIL FILLED. Widely used because of over all economy and proved dependability. High in efficiency and reserve thermal capacity. Vault or subway types.



CHLOREXTOL LIQUID FILLED. *Chlorextol* liquid is non-inflammable. For use where safety codes require extra safety. Vault or subway types.



NEW SEALED DRY TYPE. No fire or explosion hazard. No coolant necessary thanks to Class H insulation. Core and coils hermetically sealed in an inert gas.

YOU CAN LEARN about excellent Allis-Chalmers transformer performance by talking to engineers and operators of network systems . . . men who specify and buy network transformers. Proof of top performance can be found in the steady growth of installations with the familiar A-C trademark in major electrical system coast to coast. Today over 1,000,000 kva of Allis-Chalmers Network transformers are in service . . . operating continuously and dependably, supplying economical power to homes, business and industry.

One reason for wide acceptance of A-C Network transformers is the Allis-Chalmers time-proven circular coil design. Outside core clamping bolts and highly efficient turn-to-turn insulation permit high thermal capacity, even under the most severe load conditions. Another reason is the mechanically compact assembly, sturdily built to withstand adverse conditions.

Shot blasted 3-coat baked-on paint surfaces give superior protection. Undercoating protects areas most subject to corrosion. Main cover, welded to the tank, eliminates large gasket.

Take advantage of Allis-Chalmers wide range of ratings and types. Choose the network transformer that is best for your system . . . Oil-filled, *Chlorextol* liquid filled or the New Sealed Dry-Type.

Call in an Allis-Chalmers representative early in your network planning stages for his unbiased recommendation on the best suitable type for your system. Write Allis-Chalmers, Milwaukee 1, Wisconsin for bulletin 61B6152A. A-3288

Chlorextol is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Network Transformers — Over 1,000,000 KVA Installed

Everyone knows how Pinco Wet Plastic Process Porcelain gives Pinco 2- and 3-part Pin Types unexcelled insulating qualities . . . how Pinco design provides husky sections and beaded edges to eliminate mechanical failure. But it's the built-in features (exclusive manufacturing techniques) not apparent to the eye in the completed unit, that provide those "plus" values so essential to RIGHT ON THE JOB performance.

What are some of these "plus" values? . . .

1. Pinco resilient compounds, applied to the porcelain surfaces in contact with cement, completely relieve the effects of thermal expansion at any temperature encountered in service.
2. Pinco cementing processes involve laboratory-controlled mixing techniques, and curing in special rooms where temperature and humidity are rigidly regulated.
3. Porcelain sand grains are of uniform size and are applied in belts of even thickness and width.

These are some of the reasons why "right-on-the job" specifiers and buyers are selecting Pinco Multi-Part, High Voltage Pin Types to insure RIGHT ON THE JOB performance.

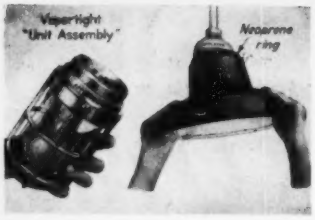
See page 38, Pinco Catalog No. 49
for complete electrical and mechanical characteristics.

The Porcelain Insulator Corporation
761 Main St., Lima, N. Y.

Sales Agents: JOSLYN MFG. & SUPPLY CO.
Offices in Principal Cities

PINCO INSULATORS

Suspension Insulators . . . Switch and Bus Insulators . . . Distribution Clamps . . . Distribution Pin Types and Guy Strains . . . Transmission Line Fittings . . . Tree Insulators . . . Transformer and Circuit Breaker Bushings . . . One Piece and Multi-part High Voltage Pin Types . . . Suspension and Strain Clamps . . . Indoor Bus Support Porcelain . . . Lightning Arrester Porcelain



vides wireless spring leaf electrical contact between fixture body and lamp receptacle. This permits receptacle with lamp, vaportight globe, and guard to be unscrewed as a single unit without tools for relamping or cleaning. Reflector is held in place by a neoprene ring around its top rim; the ring has a bead which snaps into a grove encircling the fixture body. Bulletin 5-A covers the entire series.

Appleton Electric Co, 1701-59 Wellington Ave, Chicago 13, Ill.

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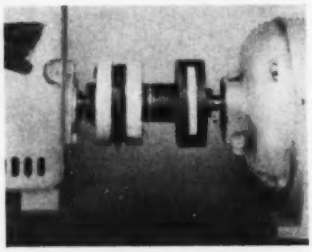
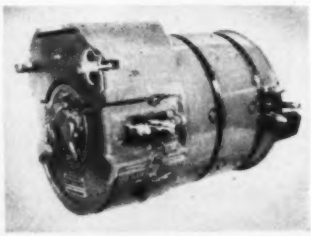


CLUTCH COUPLING—Intended for installation on shafts of integral horsepower motors to 15 hp, Series E clutch has provision for mounting a flexible coupling to provide connection between it and the driven load without need for maintaining exact alignment.

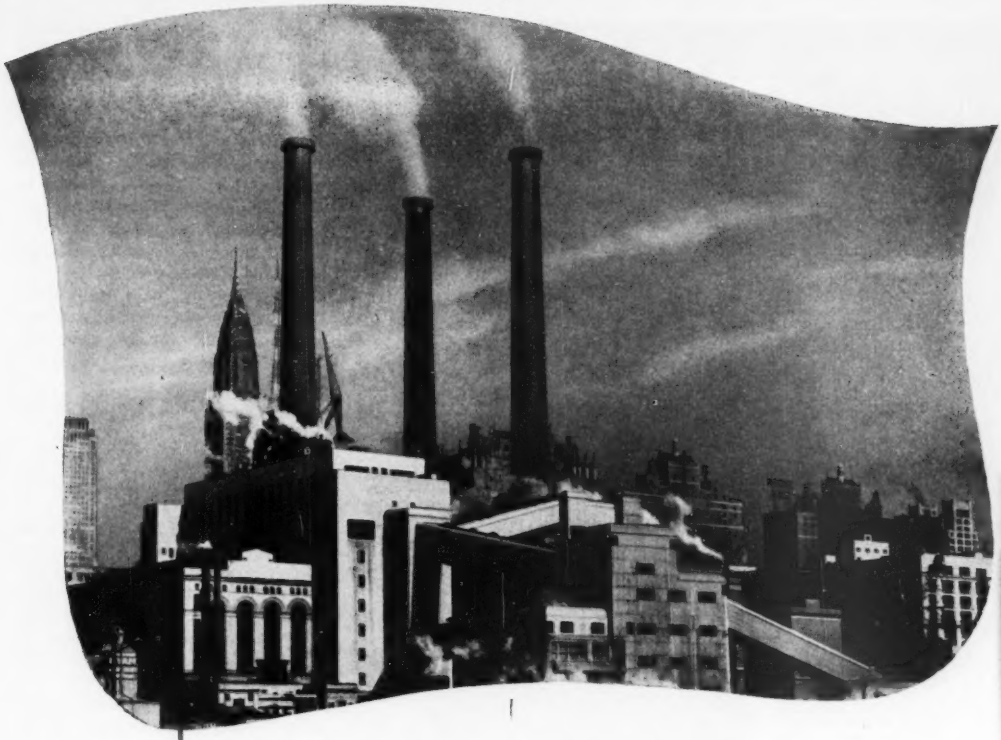
Automatic Steel Products, Inc, Mercury Clutch Div, Canton 6, Ohio

•



Motor and Controls

A 55-hp, 300-v dc motor for lightweight rapid transit cars is designed for 50 mph and above. Two motor-operated controllers make up the all-cam control system. Major develop-



Whatever equipment you prefer, here's the secret of

LOW-COST POWER

When choosing your fuel, always keep these three factors in mind:

1. ***The types available.*** Along the Baltimore & Ohio, you're sure to find the type that exactly meets your needs. The modern mines in this area produce a wide variety of excellent Bituminous.
2. ***Nearness to your plant.*** With its 11,000 miles of track, the B&O offers efficient economic transportation to plants throughout the heart of industrial America.
3. ***Reserves on hand.*** Virtually limitless reserves of power-packed Bituminous lie in the vast B&O territory—a supply that will last for centuries.

For the secret of dependable, low-cost power as related to your specific needs, *ask our man!*

Bituminous Coals for Every Purpose

LINKING 13 GREAT STATES WITH THE NATION — B&O

BALTIMORE & OHIO RAILROAD

Constantly *doing things* **—better!**

Street Lighting Maintenance
COSTS LESS
when you install HEVI DUTY
Constant Current Regulators

LAMP life is substantially improved when Hevi Duty Static Type Constant Current Regulators are used, because the resonant circuit with exclusive patented feature eliminates high inrush currents. Lamp maintenance costs are reduced. Write for Bulletin CCR-478.

HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

ments include improved commutators, better space utilization, wedged armature slots, improved insulation, and simplified bearing assemblies.

Control of the motor field strength is built into the controller, and the reverser is included as part of the circuit controller. To dissipate heat in the main motor resistor during accelerating and braking, all units are series blown and shaped for efficient utilization of cooling air.

Except for the main line-breaker, all magnetic power switches have been eliminated, and only five main cam units of necessity must be equipped with blowouts.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

•

Box Connectors

Box connectors for both metallic and non-metallic sheathed cables are equally adaptable to wiring of buildings or manufactured products. They are made of heavy-gage steel, cadmium plated for a broad range of cable sizes, including 14-2, 14-3, 14-4, 12-2, 12-3, and 10-2.

No. BX375 for metallic-sheathed cable features a cable-engaging screw which facilitates tightening and insures more positive grip on cable. The wire-entryway is intended to protect against abrasion of wire insulation.

Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N. J.

•

Cable Entrance Seal

Type RS cable entrance seal uses bushings of Resistoyl rubber material compressed in a stuffing box to form a pressure-tight, oil and moisture-proof seal on leaded and non-leaded

WHY VICTOR PINTYPES KEEP DISTRIBUTION COSTS DOWN

V RUGGED, THICK CROSS SECTION gives maximum strength and resistance to impact.

V LARGE RADIUS TOP AND SIDE WIRE GROOVES make hot-tieing easy and quick.

V SMOOTH CONTOUR *plus* smooth, hard glaze give unsurpassed self-cleaning characteristics—ideal for contaminated areas.

V MAXIMUM LEAKAGE DISTANCE conserves current, helps maintain rated voltage, and minimizes outages.

V EACH VICTOR LOW-VOLTAGE PINTYPE is individually inspected at every point of manufacture.

V HIGHEST QUALITY WET PROCESS PORCELAIN provides highest dielectric and physical strength.

VICTOR NO. 5 LOW-VOLTAGE PINTYPE. For complete engineering data on this insulator and other sizes and types, write today for Bulletin No. 4.

These are only a few of the reasons why VICTOR Low Voltage Pintype Insulators are famous for performance *and* economy. They last longer—give *extra* years of service—cut line maintenance costs to a minimum. Power men everywhere prefer VICTOR Pintypes!

Do You Know that...

The first wet process porcelain insulators were produced at Victor in 1893. In fact, many of our skilled craftsmen have been making high quality porcelain insulators at Victor for over 40 years.

Specify

VICTOR PINTYPE INSULATORS

VICTOR INSULATORS, INC. VICTOR, N. Y.

DEPENDABLE
OUTDOOR BUS SUPPORTS and FITTINGS...

THE MOST COMPLETE LINE

- BRONZE BUS SUPPORTS FOR USE WITH COPPER CONDUCTORS
- ALUMINUM BUS SUPPORTS FOR USE WITH ALUMINUM CONDUCTORS
- *Available with and without insulators*

Anderson Brass has made a specialty of assisting with solving "tough" substation bus support and connector problems. This specialty transcends all phases of electrical, mechanical and metallurgical problems.

With more than two decades of specialized electrical, mechanical and metallurgical experience in the engineering and manufacture of bus supports, fittings and connectors we are qualified to assist in improving your substation's dependability and circuit security with no extra cost. This type of service is at your disposal from Anderson Brass. We welcome the "tough" problems as well as the "easy" ones.

Consult one of our nearest 19 representatives or contact our main office.

Write today for Catalog No. 205—Outdoor Bus Supports and Fittings. Information on aluminum bus supports and fittings available on request.

ANDERSON BRASS WORKS, Inc.
POST OFFICE DRAWER 2151
BIRMINGHAM, 1, ALABAMA

• BRONZE AND ALUMINUM POWER CONNECTORS, FITTINGS AND BUS SUPPORTS
ALUMINUM SUSPENSION AND STRAIN CLAMPS

cables. Stuffing box illustrated may be drilled for 1, 2, 3, or 4 conductors, or it may be drilled for 3 conductors and neutral.

The bushings are held between metal discs and compressed by tightening a gland nut. Since the bushings are a part of the cable entrance, the proper mass of material to form an effective seal is present when the entrance is installed. Fittings for use with conduit and wire or tape armor are available.

G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

•

PORTABLE LAMP—Said to be oil resisting and watertight, the Protex portable lamp operates on 6 v from transformer secondary. Said to be safe for boilers, tanks, and other hazardous locations.

Daniel Woodhead Co, 15 N. Jefferson St, Chicago 6, Ill.

•

High-Voltage Condensers

A new line of high-voltage condensers has been designed for high temperature applications (to 85 C) as in industrial electronic equipment and vibrator power supplies. There are 26 condensers in ranges of 3,000, 5,000, 6,000, and 10,000 v dc.

Philco Corp, Accessory Div, Tioga and C Sts, Philadelphia 32, Pa.

•

Portable Electric Oven

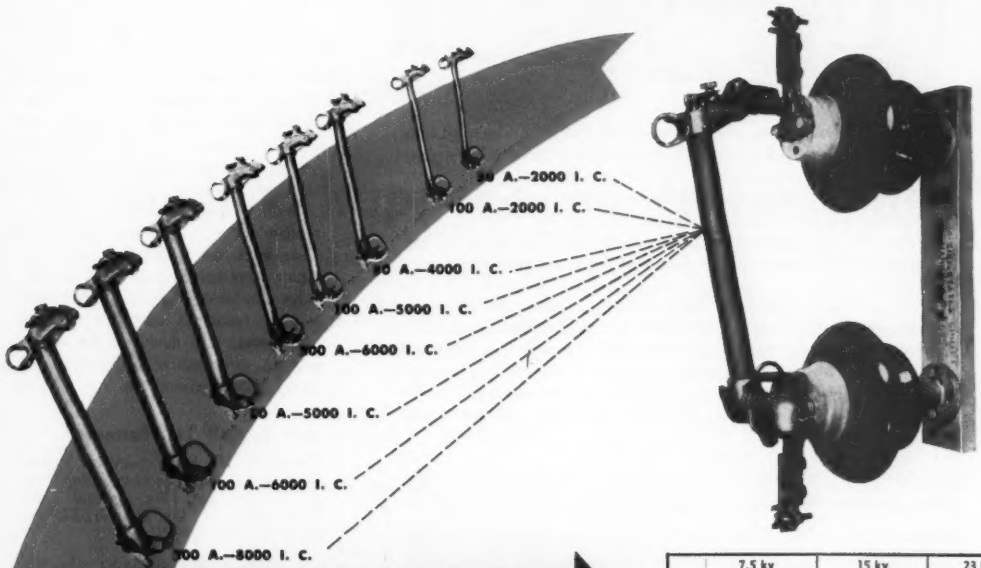
Four shelves, providing space for drying pans, are claimed to make Model PL-1 electric oven ideal for preheating plastic granules, treating powdered metals, or baking small electronic components.

Construction is all steel, with air-cell asbeston insulation. A motor-driven fan draws in fresh air and drives out stale air, eliminating stratification. Inside size is 29x24x20.5 in. high. Capable of heating to 225 F in 15 min, it may be moved from place to place and used close to production machines—wherever a 110-v outlet is available.

Grieve-Hendry Co, Inc, 1101 N. Paulina St, Chicago 22, Ill.

NOW INTERCHANGEABILITY

In Southern States' Time-Tested Line of Expulsion Power Fuses



Eight combinations of current carrying and interrupting capacities for each fuse mounting.

	7.5 kv		15 kv		23 kv	
	Amp Rating	Int. Cap.	Amp Rating	Int. Cap.	Amp Rating	Int. Cap.
LB	50 100	2000 2000	50 100	2000 2000	50 100	2000 2000
MB	50 100 200	4000 5000 6000	50 100 200	4000 5000 6000	50 100 200	4000 5000 6000
HB	50 100 200	6500 9000 11,500	50 100 200	5500 8000 11,000	50 100 200	5000 6000 8000
	34.5 kv		46 kv		69 kv	
	Amp Rating	Int. Cap.	Amp Rating	Int. Cap.	Amp Rating	Int. Cap.
LB	50 100	1000 1000	50 100	1000 1000		
MB	50 100 200	2000 3000 4000	50 100 200	2000 3000 4000	50 100 200	2000 3000 4000
HB	50 100 200	3000 5000 7000	50 100 200	2500 4000 5500	50 100 200	2000 3000 4500

Here is an expulsion power fuse line that answers the need for simple, easy convertibility to meet changing system requirements. Fuse tube assemblies are completely interchangeable in each voltage rating of this standardized group of Southern States' power fuses. Eight* combinations of current carrying and interrupting capacities are thus available in each rating by simply replacing or changing the fuse tube assembly. This simple operation affords "on the spot" adaptability to meet a variety of load conditions.

Engineered for an exacting task, this fuse line does its job better . . . at less trouble and expense to you.

**Six available in 69 kv rating.*

Southern States Equipment Corp.
HAMPTON GEORGIA

for Help when you need it
– or before – call

COMMONWEALTH

Every businessman at some time or another faces a problem of how to handle a sudden job or emergency without adding to his organization's normal personnel.

Here is experienced help when you need it . . . as you need it. On call for continuing or special programs or projects.

Forty years of experience in the utility field has given us the background and know-how to assist you in many phases of your operations.

For problems related to the introduction of natural gas, gas storage, and public relations problems accompanying the entrance of natural gas into your area, construction of new power plants or substations, metering, rates, audits, methods, financing, representation before government agencies and industry committees, reports and studies – for help with all problems confronting busy executives – call Commonwealth.

Check the ways in which Commonwealth can contribute to the efficiency and economy of your organization. Write for booklet describing the many services available to you. Address: Commonwealth Services Inc., Department 44, 20 Pine Street, New York 5, N. Y.

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ABILITY • EXPERIENCE • RESOURCEFULNESS • RESULTS

WHAT THEY'RE SAYING
at industry meetings

Engineers—Not Writers

C. J. Riley, *industrial coordinator, University of Detroit, speaking before the Cooperative Division, American Society for Engineering Education*

"It is safe to say that men in industry . . . men who have spent the better part of their lives developing the art of research, design, plant operation, and thinking at the professional level generally complain and criticize—more than any defect—the young engineer's inability to write an effective report."

Work report writing helps him realize how to utilize theoretical knowledge in a practical capacity. Apart from learning to write, it cultivates a habit of observation and analysis of technical and non-technical procedures; and develops the art of making constructive criticisms and sound recommendations.

How To Sell The Farmer

Theodore B. Hale, *vice president, General Sales, International Harvester Co, before the 17th Annual Sales Conference of the Edison Electric Institute, Chicago, Ill.*

To have a farm customer who will stay with you in good times and bad, and even from generation to generation, consider these points before going to make a sale:

1. The farmer is a good buyer when he has money or when he sees the prospect ahead of making money. But he will sit back and wait if he thinks the time is not right for buying.

2. The farm customer really has to be sold. More sales will be made across his fence than across your desk.

3. Stay long enough to tell your whole sales story. Remember that demonstration is the backbone of most successful programs of selling to farmers.

4. Know something about farming and all the other subjects that are dear to the farmer's heart.

5. Make your credit arrangements flexible. Most farmers don't enjoy regular incomes.

6. The farmer expects prompt and

"It always happens on Ironing day"

The breakfast dishes done, Mrs. Gilbert starts to work her way through a mountain of things to be ironed . . . It seems she has no more than started when—Pfft—something blows and the iron is dead as a mackerel . . . Mr. Gilbert has the car, so Mrs. Gilbert and her iron take the bus to town . . . An hour later, they are in Mr. George's shop . . .

It's the same old story—in order to save a few pennies the manufacturer had used an electrical insulation that just wasn't tough enough to stand the strain! . . . Mrs. Gilbert was glad to have her iron fixed—but she is certainly mad at the manufacturer.

Twist it . . . bend it . . . there is no splitting or cracking because no hardening varnish or lacquer is used in BH Extra Flexible Fiberglas Sleeving. It is "always as flexible as string" from −50°F to 1200°F, with color retention up to 300°F. Tough and long lasting, it resists abrasion and wear—unaffected by oil or grease.

Assembly time is speeded with the easy-to-handle tubular shape and unusual non-fraying qualities. Cut BH Extra Flexible Fiberglas Sleeving as short as you want—spread it over knobs and terminals—it will not fray! Add the feature that it doesn't support combustion and you know why this versatile electrical insulation is finding new applications every day.

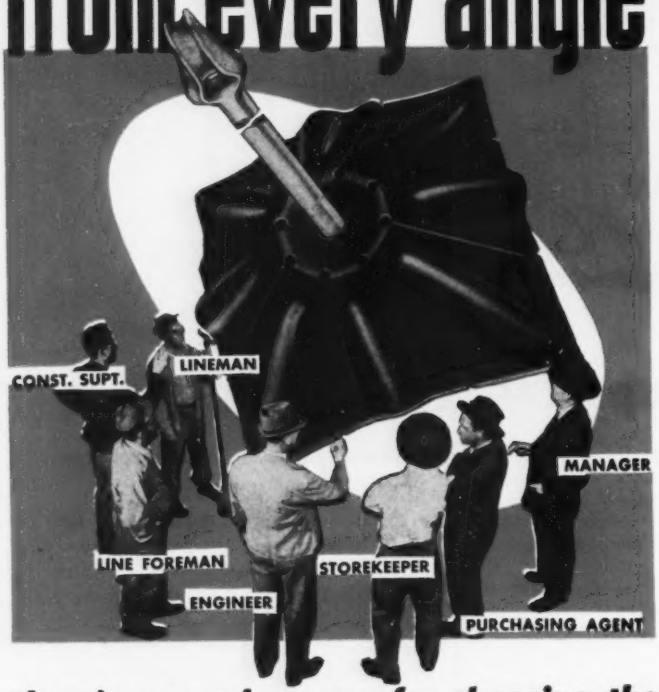
BH Extra Flexible is one of a family of BH insulations, each designed to meet particular conditions in service. Give us a few facts about your requirements—product, temperatures, voltages. We will furnish production samples for testing.

Address Dept. W-4
Bentley, Harris Manufacturing Co.
Conshohocken, Pa.

BH *Fiberglas** **SLEEVINGS**

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

from every angle



there's a good reason for choosing the

CHANCE STEEL 8-Way Expanding Anchor

Here's what the men who buy and use them say: *Linemen*—"We don't have so much weight to carry."—"It takes fewer licks to expand."... *Foremen and Construction Superintendents*—"We do save some time and labor."—"There's no danger of breakage."—"We can tell when this anchor is expanded."... *Storekeepers*—"They're easy to handle."—"Your colored identification tag is a big help."... *Engineers*—"We can depend on the uniformity of steel."—"You've taken full advantage of all the area."—"Our tests show it has susprising strength."—"The cone shape is a good idea—you get a wedging action."... *Purchasing Agents*—"Any time we can satisfy ourselves on quality at a price we like—we're happy."... *Management*—"We've seen convincing proof that our lines are going to stay put with your 8-Way in the ground."... You get more for your money in the Chance 8-Way Expanding Anchor.

CB6-93

ABC INDUSTRIES

No Know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

expert service on anything he buys.

7. Be fair in everything and be sure the customer knows you are being fair.

8. A farmer who receives fair treatment is the most loyal customer ever seen in this or any other country.

Free Enterprise Must Carry On

Merryle Stanley Rukeyser, *business news columnist, at the 17th Annual Sales Conference of the Edison Electric Institute, Chicago, Ill.*

A saving growing out of a government subsidy is illusory. Where taxpayers are taken off the tax roll through the socialization of hitherto investor-owned properties, the burden of supporting government of those remaining on the tax roll is increased. As the federal corporate income tax is raised, the value of tax exemption to partially tax-free agencies is increased.

During the national emergency, federal budgetary pressures can be alleviated by encouraging the states, the localities, and especially private enterprise to carry on those functions they are able and willing to do.

Mobilization Goals

Manly Fleishmann, *administrator of NPA, before American Management Association, New York, N. Y.*

To meet increasing military requirements and at the same time minimize the disruption of civilian economy we must provide for:

1. Expansion of production to meet the needs of the defense program and still maintain a relatively high level of civilian production.

2. Controls that will insure uninterrupted flow of scarce materials for rearmament without incurring undue civilian hardship.

Consumer Products in 1951

J. M. McKibben, *vice president and general manager, Consumer Products Division, Westinghouse Electric Corp, before the 17th Annual Sales Conference of the Edison Electric Institute, Chicago, Ill.*

The consensus at this moment, of Westinghouse and other manufacturers, is that we will turn out as much civilian product in 1951 as we did in 1949, the third largest production year in history. Our total production will be off only 20 to 25% from the record year of 1950.

Amcreco CREOSOTED POLES

do big jobs

1 **INCREASES LIFE EXPECTANCY OF YOUR LINES** Carefully selected, naturally strong timber is scientifically pressure treated the entire length to produce poles of highest strength and durability. Service records showing from 25 to 40 years of useful pole life prove the long life expectancy of Amcreco creosoted poles.

2 **LOWERS INITIAL COST . . . REDUCES MAINTENANCE EXPENSE**—Poles of practically constant strength promote pole line economy. Smaller sizes and longer spans are possible . . . a lower factor of safety can be allowed . . . lines stay up longer . . . fewer replacements of poles and cross arms are required.

3 **GIVES DEPENDABLE SERVICE UNDER SEVEREST CONDITIONS**—Lines constructed with Amcreco poles are planned for the future. Built for permanence and dependable service under all conditions, Amcreco creosoted poles provide greater long-term economy.

Get the whole story about long lasting, money saving Amcreco poles. Ask for detailed information on actual service records. Write today.

Amcreco
Lowry Process
Creosoted Products

POLES
CONDUIT
CROSS ARMS

AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY
AMCRE CO
GEORGIA CREOSOTING COMPANY
LOUISVILLE KENTUCKY

Pressure treated for strength that lasts

THIS IS A PORCELAIN INSULATING BAFFLE

It is used as an insulating, supporting and isolating member in a circular isolated phase bus run, for duty at 69Kv —the highest voltage project of this kind yet undertaken. This large porcelain "washer" is about three inches thick, with corrugated surfaces, 38″ in diameter. It is cemented into an aluminum supporting ring. A 4″ diameter bus passes through the center, and is supported by the porcelain.

Ceramic production problems involved in making such a piece are considerable. You see, a porcelain piece, between its plastic stage when it is formed, to its final fired stage, undergoes a shrinkage of about 30%. Depending on the exact way in which the piece is formed, shrinkage may be as much as 20% in one direction. Anticipating this dimensional shrinkage, to provide finished pieces of proper size and shape, *without cracking* along the way, is the ceramic engineer's skill.

At Lapp, Vacuum Process clay, and many other individualized and specialized techniques for handling, glazing, turning, drying and firing produce porcelain of unparalleled uniformity and ceramic soundness. They account for the ability of Lapp routinely to produce spectacular pieces like this. They account, also, for the superior performance of Lapp porcelain on transmission lines and in electrical systems everywhere.

If the manufacturer of the electrical equipment you specify tells you that the porcelain he uses is Lapp, you can know that he has provided a margin of safety in performance. When mechanical or electrical duty is imposed, responsibility for performance and security is placed squarely on the quality of the porcelain. The electrical industry knows that although *you can buy cheaper porcelain . . . you can't buy better porcelain* . . . than Lapp. Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

NEWS ABOUT PEOPLE

Cresap Appointed VP by Westinghouse Corp

Mark W. Cresap, Jr, management consultant, has joined Westinghouse Electric Corp as a vice president and assistant to Gwilym A. Price, president of the company.

He is co-founder of the New York

M. W. CRESAP, JR

and Chicago management consultant firm of Cresap, McCormick & Paget.

In World War II Cresap served in the Army as a colonel in charge of administrative management for the commanding general, Army Service Forces.

•

I. L. Young has been elected vice president in charge of manufacturing by the J. H. Holan Corp. He was formerly plant superintendent. **George Eckels** was promoted to chief engineer.

E. R. Moore, assistant chief engineer of Detroit Edison Co, has been elected president of Tau Beta Pi, national engineering honor society. **T. C. Hanson,** head of the civil engineering department at the University of Detroit, has been named vice president.

F. J. Rohring, Southern California Edison Co lighting engineer, has been elected president of the Electrical Maintenance Engineers Association of Southern California. He was director of the 1950 Industrial Show in Los Angeles and is on the Commercial and Industrial Lighting Committee of the Pacific Coast Electrical Association.

Gregory T. Dial has been appointed industrial power engineer for the Eastern Division of Connecticut Light & Power Co, with headquarters at Willimantic. He joined the company in 1941 as industrial power engineer of the New Britain district, following 11 years with Consolidated Edison Co, New York.

•

General Electric Sends Howell to Washington

Edwin H. Howell has been appointed special representative of General Electric Co's Apparatus Department in Washington. He will be succeeded as manager of sales of the Meter and Instrument Divisions by Donald E. Craig, assistant divisional sales manager.

Howell will direct his activities specifically to liaison with governmental agencies created in connection with the national defense program. He joined GE's test course in 1922 and later served as transformer specialist at New York, Dallas, Cleveland, and Cincinnati; manager of the GE office in Memphis; and manager of the Toledo office.

Craig worked for the Sioux Falls, S. D., Municipal Light & Power Department and Northern States Power Co before going to GE in 1936. Subsequent assignments included design and application studies of utility power systems, promotion and development of unit substations, and management of sales for the unit substation section.

•

W. D. Sharpe, senior electrical engineer with Seattle City Light since 1948, has joined the Seattle staff of R. W. Beck & Associates, consulting engineers for Washington PUD's.

Citizens Utilities Names Briggs and Kibler VP's

Citizens Utilities Co, Greenwich, Conn., has named Joseph C. Briggs to the newly created office of administrative vice president. Ray S. Kibler was elected vice president of operations.

Briggs, who had been secretary-

J. C. BRIGGS

R. S. KIBLER

treasurer of Citizens, will continue to be treasurer of the company. In his new post he will be responsible for the administrative aspects of the utility's operations and organization and for the coordination of operating, commercial, and accounting functions.

Kibler will be in charge of the company's operating and engineering functions. Before joining Citizens in

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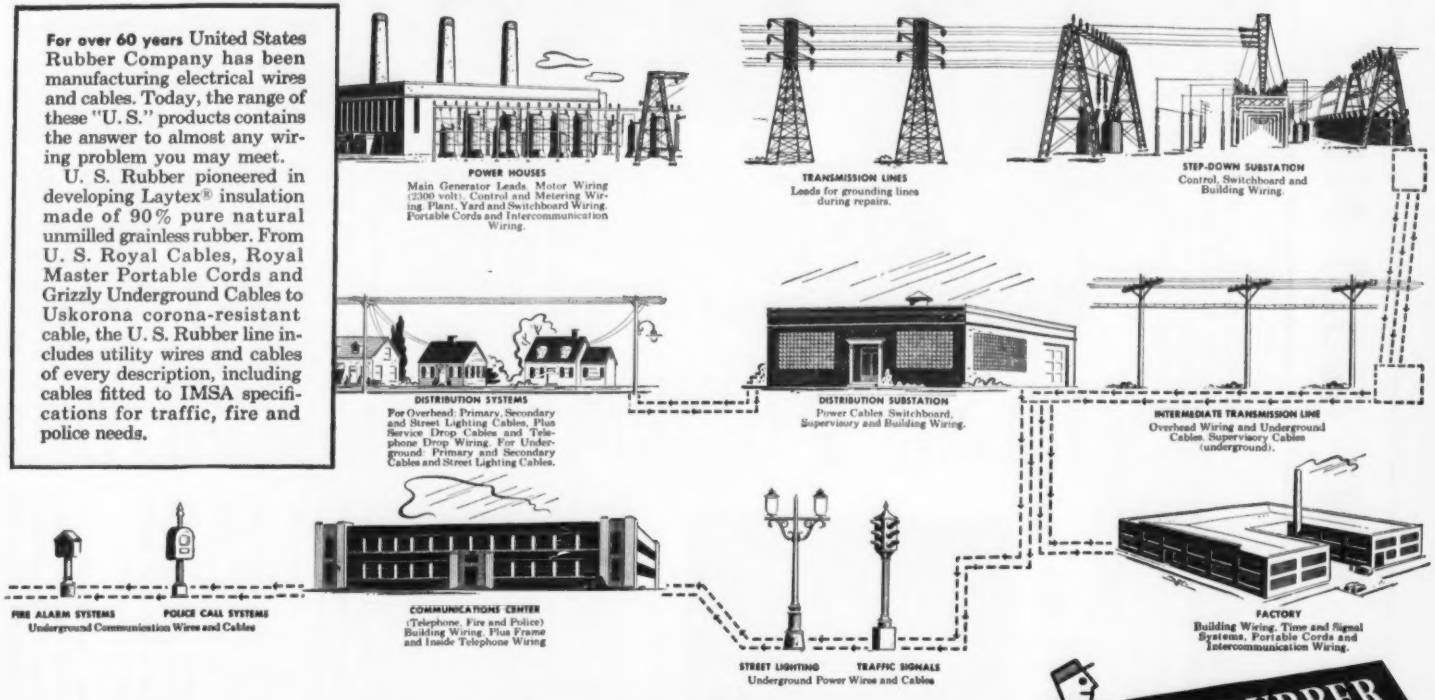
For over 60 years United States Rubber Company has been manufacturing electrical wires and cables. Today, the range of these "U. S." products contains the answer to almost any wiring problem you may meet.

U. S. Rubber pioneered in developing Laytex® insulation made of 90% pure natural unmilled grainless rubber. From U. S. Royal Cables, Royal Master Portable Cords and Grizzly Underground Cables to Uskorona corona-resistant cable, the U. S. Rubber line includes utility wires and cables of every description, including cables fitted to IMSA specifications for traffic, fire and police needs.


POWER HOUSES
Main Generator Leads, Motor Wiring (2300 volt), Control and Metering Wiring, Plant, Yard and Switchboard Wiring, Portable Cords and Intercommunication Wiring.
TRANSMISSION LINES
Leads for grounding lines during repairs.
STEP-DOWN SUBSTATION
Control, Switchboard and Building Wiring.
DISTRIBUTION SYSTEMS
For Overhead: Primary, Secondary and Street Lighting Cables, Plus Service Drop Cables and Telephone Drop Wiring. For Underground: Primary and Secondary Cables and Street Lighting Cables.
DISTRIBUTION SUBSTATION
Power Cables, Switchboard, Supervisory and Building Wiring.
INTERMEDIATE TRANSMISSION LINE
Overhead Wiring and Underground Cables, Supervisory Cables (underground).
FIRE ALARM SYSTEMS
POLICE CALL SYSTEMS
Underground Communication Wires and Cables
COMMUNICATIONS CENTER
(Telephone, Fire and Police) Building Wiring, Plus Frame and Inside Telephone Wiring
STREET LIGHTING
TRAFFIC SIGNALS
Underground Power Wires and Cables
FACTORY
Building Wiring, Time and Signal Systems, Portable Cords and Intercommunication Wiring.

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Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.

U.S. RUBBER
SERVING THROUGH SCIENCE

1948 Briggs was staff accountant for International Telephone & Telegraph Co and later assistant controller and treasurer of Mexican Telephone & Telegraph Co.

Kibler has been connected with the utility industry for 25 years. He did private consulting work before coming to Citizens this year. Prior to that he worked for Central Illinois Electric & Gas Co as construction superintendent and chief engineer, and on properties managed by Stone & Webster Service Corp including Missouri Utilities Co, and Arkansas Utilities Co, and for Community Power & Light Co.

•

EEI Names H. H. Beaty Rural Service Manager

Harold H. Beaty has been appointed rural service manager of Edison Electric Institute. He succeeds W. J. Ridout, Jr who recently was named editor of "Electricity on the Farm" (EW, Jan. 15, p 108).

In his new position Beaty will direct farm electrification activities of EEI and will assist the various committees of the institute's farm section.

H. H. BEATY

Since 1936 he has been in charge of electrification programs at Iowa State College where he directed extension, research, and teaching activities in rural electrification. Prior to his appointment at Iowa State he was associated with Iowa Electric Co.

•

Dr. E. H. Schulz, chairman of the Electrical Engineering Department at Armour Research Foundation of Illinois Institute of Technology, has been named 1951 president of the National Electronics Conference, Inc. **Dr. W. G.**

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. . . and the
linemen, too!
IT'S CLEAN! IT'S CERTAIN!
You'll get lots of praise from linemen when you specify Penta Preservative treatment. That's because a Penta-protected pole is clean—it's easy on the men who climb it.
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Worry! Fret! Loss of sleep thinking about fire cutting into production time... destroying valuable records ... costing lives of employees... all are anxieties of the past when your factory's protected with modern, approved C-O-TWO Fire Protection Equipment.

For example, the new C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing Systems keynote flexibility to meet your particular fire protection needs. Flammable liquids, electrical equipment, storage and manufacturing processes can all be made firesafe from a single low pressure carbon dioxide storage tank . . . capacities range from one to fifty tons of fire killing carbon dioxide. If fire should strike the fast-acting, non-damaging, nonconducting carbon dioxide extinguishes the blaze in seconds . . . no water damage, no lingering odors.

Further, when a C-O-TWO Smoke or Heat Fire Detecting System is used in combination with a C-O-TWO Low Pressure Carbon Dioxide Type Fire Extinguishing System, the first trace of smoke or spark of fire in a protected area immediately sounds an alarm . . . then the fire quenching carbon dioxide is readily released into the threatened area.

So, whatever your fire protection problem, let an expert C-O-TWO Fire Protection Engineer help you in planning complete and up-to-date fire protection facilities now. Write us today... tell us about your particular fire hazards, our experience is at your disposal . . . no obligation of course.

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Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

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Squeez-Grip Carbon Dioxide Type Fire Extinguishers • Dry Chemical Type Fire Extinguishers

Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems

Built-In Smoke and Heat Fire Detecting Systems

Dow, Electrical Engineering Department, University of Michigan, has been named chairman of the board.

Winthrop E. Mange has been elected assistant vice president of Consolidated Edison Co of New York, Inc. Mange will continue to serve as president of Staten Island Edison Corp, a Con Edison subsidiary, a post he has held since 1938. **Harold I. Shakeshaft,** vice president of Staten Island Edison, will take over Mange's duties as general manager of that company.

Lawrence M. Howe has been appointed general manager of Bolivian Power Co, Ltd, to succeed **H. G. Michell,** who has retired. Howe joined the company in 1942 as superintendent of the La Paz division and was assistant general manager at the time of his promotion. Michell came to Bolivian Power as Oruro manager in 1939 after service with several other utilities.

Dr. R. M. Bowie, former manager of the physics laboratories of Sylvania Electric Products, Inc, Bayside, N. Y., has been appointed director of engineering for that company.

Roy S. Allison has been appointed manager of the commercial department of the combined Genesee and Ontario Districts of Niagara Mohawk Power Corp. Allison was formerly vice president of Niagara, Lockport & Ontario Power Co, now consolidated into Niagara Mohawk.

Leo A. Mayo has been named to the newly-created post of director of methods for Connecticut Light & Power Co, Hartford. He had been in charge of customer accounting in the company's service area. **Carl B. Larson** will assist him in a program of simplification of practices in company departments. **Marcel F. Young** has assumed Mayo's former duties.

Merle Johnson has been appointed manager of Lewis County PUD after serving for a month as temporary manager. He had been senior engineer for a year before that assignment.

Carl C. Nelson has resigned as vice president and works manager of Electric Machinery Manufacturing Co, Minneapolis. He had served the company in engineering and manufacturing positions since 1926. **E. Waldemar**

TRANSFORMER PRINCIPLES AND PRACTICE

1. Gives nonmathematical descriptions of various types of transformers and the principles underlying their application. Presents modern data on current limiting reactors and new illustrations showing up-to-date construction practices. Gives a detailed discussion of single and three-phase transformers, coils, and cores, maintaining oil quality, transformer polarity, special applications of standard transformers, and NEMA instructions in the care and operation of transformers. **By J. E. Gibbs, Electrical Engineering. Second Edition. 268 pages, $4.00**

ELECTRIC DISTRIBUTION FUNDAMENTALS

2. Provides sound solutions to problems of electric distribution, essential data on design and construction, operation, and service, methods and equipment, and mechanics and materials. Discusses how the distribution system works—how it is planned, designed and constructed—how service and operating routine is handled. Covers voltage drop, wire size calculations, etc., etc. **By F. Sanford, Copper Wire Eng'r, Assoc. Second Edition. 252 pages, 163 illus., $4.00**

RURAL ELECTRIFICATION ENGINEERING

3. Covers the fundamental design features of rural distribution lines; the basic factors underlying the application of electricity to heat, light, and power; and the administrative problems involved in a sound, progressive rural electrification program. Includes advice on selection of construction materials, layout and mechanical design of rural lines, etc. **By U. F. Earp, Assoc. Agr. Engineer, Va. Agr. Experiment Station. 313 pages, 278 illus., $4.00**

TRANSIENT PERFORMANCE OF ELECTRIC POWER SYSTEMS

4. Covers transient electrical phenomena, emphasizing their physical character, as they occur in today's power systems. Aids in devising methods of preventing damage in the networks. Deals with both intentional and unintentional transient performance as they relate to commutation conductors, symmetrical components connected with ground faults, etc. **By Reinhold Rudenberg, Gordon McKay Professor of Electrical Engineering, Harvard U. 832 pages, 734 illus., $12.00**

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PHOTOELECTRIC CONTROL

FOR STREET LIGHTING

This new Fisher-Pierce Control is the result of long experience in design and manufacture, combined with practical experience of more than 600 electric utilities in more than 20,000 installations.

The new 63300 B Control is mechanically and electrically interchangeable with existing controls. The same dependable Fisher-Pierce circuit, consistently giving tube life of more than 20,000 hours, has been retained. Improved spacing and insulation provides increased protection against lightning damage . . . up to 2500 volts rms Hipot. Mechanical design has been altered to provide maximum simplicity for greater economy of servicing.

FP

The FISHER-PIERCE Co., Inc.

82 CEYLON STREET, BOSTON 21, MASS.

Sjoquist will succeed him as works manager. Sjoquist has been with the company since 1925 as chief mechanical engineer and since 1948 as consulting engineer.

Dr David I. Sinizer has been appointed technical liaison officer of Massachusetts Institute of Technology, Cambridge. He will work with industrial organizations contributing to MIT's program of research and education.

•

Ely Is Sales Director for Connecticut L&P

Robert G. Ely has been appointed director of sales for Connecticut Light & Power Co. He had been assistant

R. G. ELY

manager of power sales for Public Service Electric & Gas Co, Newark.

Howard W. Memmot has been named industrial manager by Connecticut L&P.

Ely started with Public Service in 1926 in power sales and in 1933 was placed in charge of power sales in the Jersey City district. Four years later he was named assistant manager of power sales for the entire Public Service system.

Memmott has been with the Connecticut utility since 1933. He became industrial power engineer in the Danielson district in 1937 and was appointed industrial power head for the eastern division in 1949. He is chairman of the Power Engineers Association of New England.

•

D. O. Eschbach has been appointed general sales manager of Roller-Smith Division, Realty and Industrial Corp and Electric Power Equipment Corp,

It's time we got *working* mad!

As we listen to the latest insults from Moscow, we're likely to get fighting mad.

Instead, we'd better use our heads and get *working* mad.

It is clear by now that Stalin and his gang respect just one thing—strength. Behind the Iron Curtain they've been building a huge fighting machine while we were reducing ours. Now we must rebuild our defenses—*fast.*

As things stand today, there is just *one* way to prevent World War III. That is to re-arm—to become strong—and to stay that way!

This calls for better productivity all along the line. Not just in making guns, tanks and planes, but in turning out civilian goods, too.

Arms must come first. But we must produce arms *at the same time* we produce civilian goods.

We can do this double job if we all work together to turn out more for every hour we work—if we use our ingenuity to step up productivity.

All of us must now make sacrifices for the common good. But we're working for the biggest reward of all —*peace with freedom!*

THE BETTER WE PRODUCE THE STRONGER WE GROW

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL ·

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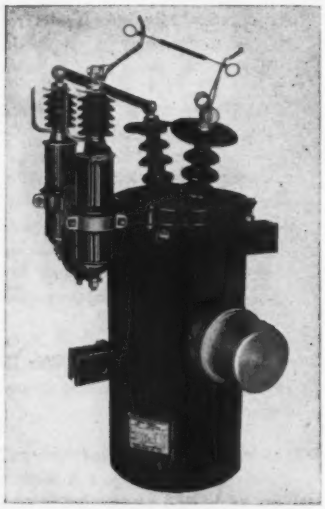

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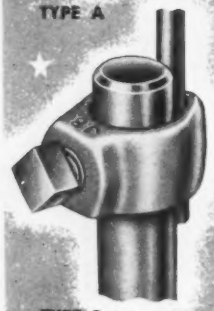
Low Cost • Pole Mounted • Light Weight (280 lbs.) • Minimum Maintenance • Easily Installed • Will Regulate 300 KVA at 7,200 Volts • 3.75% Boost • Completely Protected • $427.80 Eastern Zone

With RT&E's new type, light weight pole mounted Regulator, installation can be made on the line where regulation is most needed. *Type IR Regulators* can be placed in series on the line where more than 3.75% boost is required.

Write for Brochure

RURAL transformer & equipment co.
MILWAUKEE WISCONSIN

TYPE A



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BLACKBURN *Hi-Strength* Ground Rod Clamps

The complete line of clamps is cast of high-strength Duronze and uses Duronze set screws — truly high-strength construction throughout. Type A is a heavy clamp with floating pressure bar to align and protect the ground wire. Type B is the "Budget Line" clamp, but it makes a tight, trouble-free connection. For higher quality at lower cost, specify BLACKBURN.

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an affiliate. He succeeds **R. F. Schall,** who resigned to join I-T-E Circuit Breaker Co. He formerly served as central station sales manager for Roller-Smith.

Wilbur H. Armacost, vice president in charge of engineering of Combustion Engineering - Superheater, Inc, New York, has received a Stevens Honor Award Medallion. The award, presented by Stevens Institute of Technology, Hoboken, N. J., was for notable achievement in the field of steam generation.

W. C. Carpenter has been named assistant sales manager for R. Thomas & Sons Co, Lisbon, Ohio. He formerly was in charge of sales of power switching equipment with Memco Engineering & Manufacturing Co, Inc.

Austin D. Barney, president of Hartford Electric Light Co and Connecticut Power Co, received the honorary degree of doctor of engineering at a recent commencement of Rensselaer Polytechnic Institute. Barney was cited for "able leadership in the public utility industry and high sense of civic responsibility."

Francis X. Doherty has been appointed executive assistant in charge of the western division of Niagara Mohawk Power Corp. He was vice president and general manager of Niagara Falls Power Co until its recent consolidation with Niagara Mohawk.

Carl Sink has resigned as advertising manager of Tide Water Power Co, Wilmington, N. C. to join the staff of the "Herald-Sun" papers in Durham, N. C.

Arthur C. Spurr, president of Monongahela Power Co, has received an honorary doctor of laws degree from Marietta College, Marietta, Ohio.

Garth Griffiths has been appointed deputy chief engineer of the British Columbia Power Commission. He formerly was superintendent of the coastal region.

A. G. Carson of Green Bay, Wis., has retired as vice president and chief engineer of the Wisconsin Public Service Corp. He will continue as a consultant until the completion of a 62,-

WESTERN LARCH has many fine qualities that make it ideal for telephone and transmission pole use... high bending strength; high compressive strength; high shock resistance; unusual hardness; durability; long life and low service cost.

Western Larch is grown by J. Neils on virgin forest lands; produced and treated in the company's modern pole plant.

J. Neils Lumber Company, manufacturer of quality forest products since 1895, invites your inquiry on treated Western Larch poles. An illustrated folder about us, our pole facilities, and how we can serve your requirements, will be furnished on request.

500-kw generating unit at the Pulliam Bayside plant there. **G. S. Meyrick,** assistant chief engineer, has been appointed acting chief engineer.

OBITUARY

Joseph Bell Mayer

Joseph Bell Mayer, 103, organizer and retired officer of several public utility companies, died April 5 in New York. Among the companies established by Mayer were Lima (Ohio) Electric Light & Heat Co, Louisville (Ky.) Lighting Co, the Fort Wayne (Ind.) Lighting Co, and the Erie Lighting Co.

Mayer supervised the erection of high tension transmission lines in western New York and northern Pennsylvania in connection with power from Niagara Falls.

He served as president of Olean Electric Light & Power Co, vice president of Bradford Electric Co, and director of Erie Lighting Co.

•

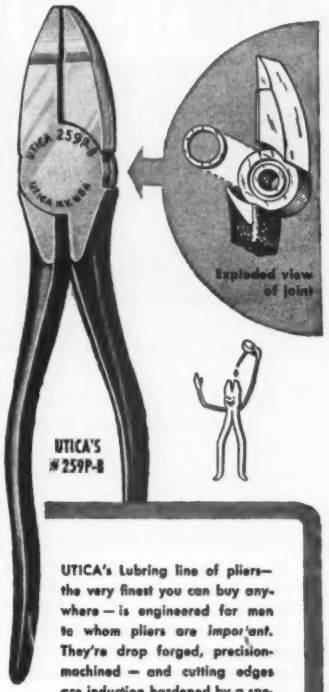
Martin P. Walsh, 60, Youngstown division supervisor of advertising and publicity for Ohio Edison Co, died in that city March 30. He had been with the utility for 39 years, serving in various capacities. Before taking over the advertising and publicity post he had supervised rate applications and rural sales.

Glen L. Steckley, 48, former secretary of the Indiana Public Service Commission, died at Indianapolis March 30. He served as secretary of the commission from February, 1943 until December, 1944. He also had been attorney-examiner for the body.

Gordon Lawton Sherk, 72, area superintendent of the Niagara district of Hydro-Electric Power Commission of Ontario, died April 9 at St. Catherines. Sherk started with Lincoln Electric Light Co., Hamilton, Ont., and became manager of the company. He served the company for 40 years.

W. A. Bonnycastle, British Columbia hydro and consulting engineer, died recently at Riverside, Calif. He did preliminary work on the Ruskin and Stave Falls projects for British Columbia Electric Railway Co.

PLIERS THAT OIL THEMSELVES!



UTICA's Lubring line of pliers—the very finest you can buy anywhere—is engineered for men to whom pliers are *important*. They're drop forged, precision-machined — and cutting edges are induction hardened by a special UTICA process.

Each UTICA "Lubring" pliers has a ring of porous iron floating in the joint. This ring serves as a tiny reservoir for oil and releases it to the joint *as it's needed*.

In these days of limited replacements, why not make sure you get the long life and quality that go with UTICA?

UTICA Drop Forge & Tool Corp.
Utica 4, New York
In Canada:
Adam Tool & Supply Co., Ltd., Montreal
Wells-Irons, Ltd., Winnipeg

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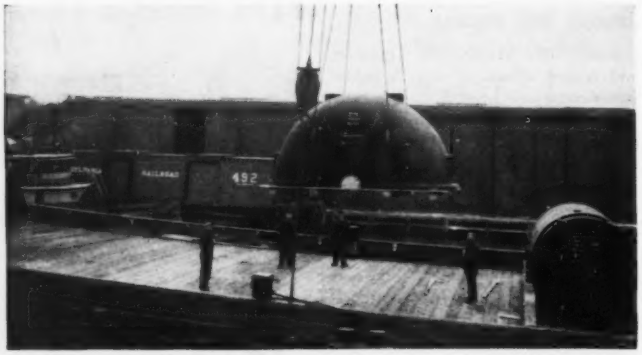

TURBO CASING shipped to New York from Brown Boveri plant in Baden, Switzerland, is being transferred to a lighter for shipment by rail to Cleveland

Generator for Cleveland Arrives from Europe

The first of two Brown Boveri 25,000-32,500-kw turbogenerators, to be installed in the Cleveland, Ohio, municipal plant, has arrived in New York from Baden, Switzerland.

The partial shipment included heavy rotors, castings, and other components of turbo sets. Commissioner Frank J. Schwemler, in charge of engineering for the Cleveland Public Works Department, was on hand at New York to inspect the equipment.

The second turbo set is scheduled for shipment next month and may be shipped directly for unloading in Cleveland via the Great Lakes.

The installation of the turbo sets is part of Cleveland's $10-million expansion program.

•

Appliance Department Split into 2 Parts by GE

General Electric Co has split its Appliance and Merchandise Department into two separate departments for the manufacture and sale of major appliances and small appliances.

The Major Appliance Department will be headed by Clarence H. Linder. Charles K. Rieger has been named general manager of the Traffic Appliance Department.

Under the new setup the Major Appliance Department will be responsible for refrigerators, food freezers, ranges, water heaters, washers, ironers, dryers, dishwashers, garbage disposers, and cabinets. Irons, toasters, roasters, sandwich grills, waffle irons, mixers, fans, clocks, vacuum cleaners, automatic blankets, heating pads, heaters, and heat lamps will be handled by the Traffic Appliance Department.

The new appliance departments will have separate engineering, manufacturing, sales, advertising, and research staffs.

The move follows announcement by the company of a plan to expand its major appliance manufacturing facilities at an "Appliance Park" to be established somewhere in the Midwest. GE does not plan to abandon any of its present manufacturing facilities. The new facilities first will be used for war goods production and later will be converted to appliance output.

•

Metal Prices
April 16, 1951

COPPER, Conn. V., lb	$ .24½
LEAD, N. Y., lb	.17
ZINC, prime Western, E. St. Louis, lb	.17½
TIN, Straits, qual., N. Y., lb	1.47
ALUMINUM, ingot, base price	.19
NICKEL, base price	.50½
STEEL, billets, Pitts., ton	56.00
STEEL, scrap, No. 1 heavy, Pitts., ton	45.00

1,400-Mile Microwave System to Serve Pipeline

Plans for one of the most extensive and modern microwave systems in the United States have been announced by Texas Eastern Transmission Corp. The system will operate at 2,000 mc and will employ Pulse Time Modulation Multiplex equipment.

Initially, the system will be equipped for operation on eight voice channels, with provision for VHF mobile radio connection, dispatching, administrative, telemetering, and supervisory services. The system can be readily expanded to provide 23 channels.

The route of the system will be from company headquarters at Shreveport, La., to Kosciusko, Miss., then along the route of the 30-in. pipeline now under construction to Connellsville, Pa., and from there to the eastern terminal at Linden, N. J.—approximately 1,400 miles.

•

Power Disagreement Holds Up Alcoa Plant

Failure of the Chelan County PUD and Puget Sound Power & Light Co to reach an agreement on furnishing power to Aluminum Co of America is endangering proposed construction of a $65-million aluminum plant near Wenatchee, Wash., Rep Henry M. Jackson declared recently in a speech at Wenatchee.

The legislator said, "If agreement is not reached, I have been informed that Alcoa will take the plant to New Orleans, where they can get electric power generators from natural gas at a 3-mill-per-kwhr rate."

MANUFACTURING BRIEFS

Employees of the East Pittsburgh divisions of Westinghouse Electric Corp set a safety record during the 12 months of 1950. They worked more than 35 million manhours with the lowest accident severity figure in

the plant's 57-year history. Less than 1½ hour's time was lost because of disabling accidents for each 1,000 hours worked, about one sixth the national average for all industry.

Permanent magnets containing only non-critical material for applications in radio and television receivers have been announced by the metallurgical laboratories of Sylvania Electric Products Inc. The new magnets should be available in commercial quantities at an early date.

Minneapolis-Honeywell Regulator Co has agreed to act as consultant to the Atomic Power Division of Westinghouse Electric Corp. Honeywell engineers will assist the Westinghouse division in solving valve problems.

General Electric Co has adopted a new marking design for light bulbs of 15 to 100 w so that customers can identify the wattage more easily. The wattage will be displayed in the center of the marking replacing the GE monogram. The revised marking was undertaken first on 75-w bulbs and is being adopted on other lamp sizes as rapidly as possible.

Baldwin-Lima-Hamilton Corp has closed its offices at 120 Broadway, New York 5, N. Y. All sales activities in the New York area will be coordinated in the firm's offices at 60 East 42nd St, New York 17.

Westinghouse Electric Corp's Minneapolis Lamp Sales Division has tripled its office and warehouse space by moving its headquarters in that city. The new warehouse, located at 727 Second Ave, North, has 18,000 sq ft of floor space, enough to store 3.5 million light bulbs of various types.

SALES ASSIGNMENTS

COMPANY STAFFS

Ohio Brass Co, Mansfield, Ohio, had added Joseph B. Doran and William E. Morrison to its staff of district managers in the Eastern territory. Both will have their headquarters in the New York office.

Simplex Wire & Cable Co, Cambridge, Mass., has appointed W. H. Davis manager of its Chicago district office. He succeeds J. N. Macalister, who is retiring after more than 48 years with Simplex, 17 of them as Chicago manager.

On New Rochelle's thoroughfares it's

AMPLEX STREET LIGHTING LAMPS

The vastly improved street lighting system in New Rochelle, N. Y., recently installed under the supervision of Mr. E. P. Byrne, the city's Electrical Superintendent.

IN EVERY PART of America, more and more municipalities and public utilities are changing over to Amplex Street Lighting Lamps. Experience shows that these lamps afford notably superior lighting and maintain an unsurpassed degree of light output during their extra-long service lives. Specially designed and built to withstand the constant vibration and jolts of traffic, they bring outstanding savings on every installation.

There's an Amplex street lighting lamp of the right type and wattage for every purpose. And for the last word in ruggedness and dependability Amplex **Weatherproof Bulbs** are your topmost specification. Made of "hard glass", these moisture-resistant lamps stop failures caused by climatic conditions . . . bring down long-run costs.

For full facts about Amplex Street Lighting Lamps and their superiority on the job, write Amplex Corporation, Dept. J-4, 111 Water Street, Brooklyn 1, New York.

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Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

The ONLY Soldering Tool You Need for light or HEAVY Work!

Switch *instantly* from light to heavy work—or vice versa—with the 250-watt Weller Soldering Gun. *Controlled* dual heat makes the Weller Gun the only soldering tool you need for *all types* of work. 5-second heating saves time and current on every job, too. Your Weller Gun pays for itself in a few months!

250-Watt WELLER SOLDERING GUN

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• TRIGGER-SWITCH CONTROL
Governs heat and saves power because no need to unplug gun between jobs. Heat goes off when you release trigger.

• 5-SECOND HEATING—No waiting, no wasted current. Saves hours and dollars each month.

• SOLDERLITE—Spotlights the work. Lets you see what you're doing at all times, even in dark corners.

• LONGER REACH—Lets you get at any job with ease. Slides between wiring, into the tightest spots.

• STREAMLINED—Compact and comfortable to hold. Pistol-balanced for fast precision soldering.

• WELLERTIP—Rigid and chisel-shaped with more area for faster heat transfer. Over/under terminals brace tip, give greater visibility.

• DUAL HEAT—Single heat 200 watts; dual heat 200/250 watts; 120 volts; 60 cycles.

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817 Packer Street, Easton, Pa.

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona-Nevada—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., radio communication equipment, Davis Dam Proj., Spec. DS-3359.

California—Pacific Gas & Electric Co., 245 Market St., San Francisco, Calif. **$4,000,000** transmission line from Eureka to Cottonwood Shasta Co.; **$487,000** condenser kilowatt emperer to be installed at Humboldt sub-station.

California—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Herdlyn, Cal., transformers for Tracy switchyard, Central Valley Proj., Spec. DS-3383. L. N. McClellan, ch. engr.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, furnishing, del. f.o.b. cars shipping point or f.o.b. cars Granby, outdoor switchyard, incl. transformers, air switches, disconnecting fuses, fuse cutouts, supporting steel structures, etc. for Willow Creek Switchyard, Colorado Big Thompson Proj., Spec. DS-3379. L. N. McClellan, ch. engr.

Conn., Hartford—The Hartford Electric Steel Corp., 540 Flatbush Ave., factory, off Flatbush Ave. **$1,000,000.**

Georgia—Canoochee Electric Membership Corp., Reidsville, warehouse and office. Plans deposit $25. Southern Eng., 1000 Crescent Ave., Atlanta, archts.

Illinois—Champaign County Telephone Co., Champaign, exten. imprv. rural telephone sys. **$455,000.**

Kansas—Wheatland Electric Co-operative, Scott City, 190.65 mi. rural distr. lines, 15 mi. line changes, Greeley, Hamilton, Kearny, Logan, Scott, Wallace and Wichita Counties, **$225,000**, Frank Horton & Co., Lamar, Mo., engr.

Ky., Louisville—General Electric Realty Co., 1 River Rd., Schenectady 5, N. Y., factory, **$3,000,000** Albert Kahn Associated Architects & Engineers, Inc., 345 New Center Bldg., Detroit, Mich., consult. engr.

Mass., Amherst—State, R. D. Hawley, treas., turbine plant exten. at University of Mass., Proj. E 206, **$185,000**, Office of Hollis French, 210 South St., Boston, consult. engr.

Miss., Moorhead—City, P. A. Cook, clk., furnish, install bldg. addns. and circulating water piping at municipal power plant. $225,000. Plans deposit $20. R. D. Thomas & Assoc., 400 Metropolitan Life Bldg., Minneapolis, engrs.

N. M., Los Alamos—U. S. Atomic Energy Comn., Los Alamos, plans by Black & Veatch, 4706 Broadway, Kansas City, Mo. one 80x130 ft. rein.-con. bldg., pt. single story and pt. multi-storied, one approx. 35x100 ft. single story with bsmnt., rein.-con. bldg., clearing, grading, site imprvs., utilities, incl. water, sewer, power and steam line, **$900,000-$1,100,000.**

Nebraska—Bureau Reclamation, Box 280, Casper, Wyo., furnishing, del. transformers, lightning arresters, regulator and switching equip. for Ogallala Sub-Station, Transmision Div. Missouri River Basin Proj., Inv. No. 703S-180.

N. Y., Binghamton—Station WNBF, Arlington Hotel radio and TV station, studio and office, **$350,000.**

N. Y., New York—Bd. Transportation, 370 Jay St., Brooklyn, Zone 1, furnishing, installing condenser, heaters and mechanical equip. for 74th Street Power Plant, Manhattan Boro.

North Dakota—Bureau Reclamation, Dpt. Interior, Bismarck, construct Garrison-Fort Peck tie 115 kilovolt transmission line, Central North Dakota Power System, Transmission Div., Missouri River Basin Proj., in vicinity of Garrison Dam, Spec. No. DC-3382.

O., Toledo—Dpt. Pub. Welfare, John H. Lamneck, dir., 534 E. Rich St., Columbus, piping for No. 2 turbine generator at

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Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N.Y.

Toledo State Hospital. State Engr., 534 E. Rich St., Columbus, Zone 15, engr.

Pa., Dixmont—General State Auth., 18 and Herr Sts., Harrisburg, construct electrical distr. sys. at Dixmont State Hospital. $125,000. Plans deposit $10. J. S. Burke & Assoc., Magee Bldg., Pittsburgh, engrs.

Pa., Phila.—I. T. E. Circuit Breaker Co., 445 N. 19 St., altering mfg. plant. **$150,000.**

Tex., Amarillo—U. S. Atomic Energy Comn., Los Alamos, N. M., addnl. construction for Atomic Energy production plant (at Pantex area). $2,500,000; electric power distr. sys., **$750,000-$900,000.**

Tex., Brownsville—City, power plant, general constr., Approx. $1,500,000; (a) furnishing, erecting tanks, breeching and stack at municipal power plant, (b), power plant pipe sys., $275,000; furnishing, installing complete electrical sys. and power plant wiring for municipal power plant, $200,000. Plans deposit $25 each. Black & Veatch, 4706 Broadway, Kansas City 2, Mo., engrs.

Tex., Corpus Christi—Central Power & Light Co., N. Chaparral St., meter house addn. $100,000. Dexter Hamon, 912 Ocean Dr., archt.

Va., Norfolk—Pub. Wks. Office, Fifth Naval Dist., U. S. Naval Base, Zone 11, rehabilitation electric systems bldg. W-104 at U. S. Naval Base, Naval Supply Center, No. 27025. Plans deposit $10.

Washington—Bonneville Power Admin., 827 N. E. Oregon St., Portland, Ore., constr. Fidalgo sub-station, Inv. 5693, Anacortes, Skagit Co. Plans deposit $25. L. C. Stewart, engr.

Wyoming—Bureau Reclamation, Dpt. Interior, Casper, constr. Sinclair-Hanna 34.5-kilovolt transmission line, Kendrick Proj., between Sinclair and Hanna, Spec. DC-3380.

Low Bidders & Contracts

Awarded

California, Colorado and Wyoming—Westinghouse Electric Corp., Herdlyn, Calif., Low Bidder. **$550,011,** SUB-STATIONS for emergency power supply, Central Valley Proj., Colorado-Big Thompson Proj., Colo., and Missouri River Basin Projs., Spec. DS-3291. Bureau Reclamation, Dpt. Interior, Bldg. L-A, Denver Federal Center, Denver, Colo. Bids Apr. 5.

Oregon—Lee Hoffman, 335 S. E. Water St., Portland, Ore. Low Bidder, $627,155. Construct double circuit section, Maupin-Detroit 230 kv. line, Inv. 5666, Marion Co. Bonneville Power Admin., 827 N. E. Oregon St., Portland, Ore. Bids April 6.

Washington—F. E. Wilder, Olympia, Wash. Contract Awarded. **$510,717,** Schedule 1; **Smith Bros.,** Wash., Vancouver, **$533,439,** Schedule 2, Midway-Grand Coulee No. 3, 230 kv. transmission line, Benton, Grant, Douglas and Okanogan Counties. Bonneville Power Admin., 727 N.E. Oregon St., Portland, Ore. Bids Mar. 29, awarded Apr. 5.

Wash., Tacoma—Western Electric Co., White-Henry-Stuart Bldg., Seattle 1, Wash. Low Bidder. **$1,195,319,** four 50,000 kva transformers. City Hall, Tacoma, Wash. J. F. Ward, city light supt.

Wash., Wenatchee—Stone & Webster Eng. Corp., 49 Federal St., Boston, Mass. Contract Awarded, **$11,000,000,** design and construct raising Rock Island Dam and expanding power plant on Columbia River, near Chelan Co. Public Utility Dist., Wenatchee, Wash.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

S. C., Rock Hill—Celanese Corp., Rock Hill, S. C. plant addn. **$20,000,000.**

Tenn., Nashville—State Bd. Health, State Office Bldg., Middle Tennessee TB hospital. $4,000,000. Marr & Holman, Stahlman Bldg., Nashville, archts.

Tex., Fort Worth—Bell Aircraft Corp., Niagara Falls Blvd., Buffalo, N. Y., Unit 1, helicopter plant unit. $3,000,000.

Tex., Houston—Ethyl Corp., City Natl. Bank Bldg., doubling capacity refinery and chemical plant now under construction and also additionally-planned. **$28,000,000.**

Wash., Hoquiam—School Bd., Hoquiam, plans by John Graham & Co., Dexter Horton Bldg., Seattle 4, grade school and administration bldg. **$650,000.**

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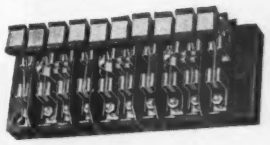

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CATALOGS • BULLETINS

● AUTOMATIC CONTROLS: Many types of industrial controls are presented in 64-page Catalog 700. Included are controls for pressure; temperature; liquid level; boiler feedwater pump; transformers and relays for unit heaters, radiant glass heat panels, electric heaters, oil burners, stokers. The Mercoid Corp, 4201 Belmont Ave, Chicago 41, Ill.

● MINERAL-INSULATED WIRING: Many applications of safety mineral-insulated wiring, techniques in terminating, and installing are given in an illustrated booklet. General Cable Corp, 420 Lexington Ave, New York, N. Y.

● LINE MATERIAL CO: "Line Material Co—Its Tools and Its Talents" is the title of a booklet describing the employees, facilities, and products of that company with the aid of numerous illustrations. Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

● INDUSTRIAL CONTROL: An 88-page catalog and technical guide covers "Relays and Switches for Industrial Control." Class B general purpose relays and two high speed rotary stepping switches are featured. Automatic Electric Co, 1033 W. Van Buren St, Chicago 7, Ill.

● MICARTA GEARS: Booklet B-4661 is meant to (1) Give an introduction to Micarta gearing; (2) provide machine, designing, and application information; (3) add new manufacturing information to that already known. Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh 30, Pa.

● RESISTOR TESTING: New data on the "Speed-Sort" low-range limits bridge appears in Bulletin 8A. Resistances between 0.25 and 20,000 ohms can be push-button tested without re-balancing between tests. Associated Research, Inc, 3758 W. Belmont Ave, Chicago 18, Ill.

● PIPING: "Flexible Ball Joints" is a 16-page bulletin describing the ball joint and its use in piping for power, process, heating, or hydraulic service. Barco Mfg Co, Dept J-11, 1801 Winnemac Ave, Chicago 40, Ill.

● RLM STANDARDS: Four-page RLM Bulletin No. 1050 contains a listing of all RLM manufacturers and the RLM-certified lighting equipment made by each. RLM Standards Institute, 326 W. Madison St, Chicago 6, Ill.

● BOILER CLEANING: Bulletin 485 presents information about the Vulcan P-3 rotary soot blower head. Vulcan Soot Blower Div, Continental Foundry & Machine Co, Dubois, Pa.

● AIR SWITCHES: Catalog 120 covers Type TW-0 outdoor group-operated rotating-insulator vertical-break air switch for 7.5, 15, and 23 kv, 400, 600, and 1,200 amp. Types TW-3 and TW-4 vertical-break air switches are covered in Catalog 123; these extend to 287 kv, 1,200 amp. Information in Catalog 165 pertains to manual operating mechanisms for rotating-insulator air switches. Pacific Electric Mfg Corp, 5815 Third St, San Francisco 24, Cal.

● WELDING AND BRAZING: A small 32-page booklet is a buyers' guide to the company's alloys and fluxes for welding, brazing, soldering, cutting, and tinning. All-State Welding Alloys Co, Inc, 273 Ferris Ave, White Plains, N. Y.

● CONNECTORS: Catalog Y53 contains not only a comprehensive, illustrated listing of Hydent connectors and installation tools for industrial, manufacturing, and aircraft use, but also full instructions for selecting connectors and installation tools. Burndy Engineering Co, Inc, New York 54, N. Y.

BOOK REVIEWS

Analysis in Electrical Engineering

Transient Analysis in Electrical Engineering. **By Sylvan Fich. Published by Prentice-Hall, Inc, New York 11. 306 pages, illustrated. Price $7.35.**

Transients call for study by means of differential equations and particularly for familiarity with the Laplace Transformation. This author has subordinated the circuits to the establishment of the mathematical tooling for attack on the transients that may occure in them. Evoluation of the procedures is carefully elucidated by numerous numerical examples. A closing chapter shows how to translate engineering systems into electrical analogs for readier appreciation.

Basic Electrical Engineering

Theory and Application of Electrical Engineering. **By E. W. Schilling. Published by International Textbook Co, Scranton, Pa. 402 pages, illustrated. Price $6.50.**

Because Dean Schilling has made no attempt to present a "unified," or strictly progressive, treatment of dc and ac circuits and machines, this text may be the more easily put to use for refresher purpoes. Straightforward explanations are complemented by clear examples and illustrations. Much more territory has been covered than is usual for an elementary treatment, including considerable information usually found in machinery texts. There are chapters on illumination and electronics, as well as space devoted to motor selection for duty-cycle operation. A quick review of transmission and distribution fundamentals comprises another chapter. When using the text as a first course, however, its broad coverage makes desirable supplementary work in dc circuit analysis and sinusoidal single-phase circuit analysis.

Mechanical Handbook

Mechanical Engineers Handbook. **By L. S. Marks. Published by McGraw-Hill Book Co, New York 18. 2236 pages, illustrated. Price $15.**

Marks' fifth edition is now available and embraces the additions to mechanical technology which have taken place since the fourth appeared in 1941. It has the same format, size and tone of the companion Standard Handbook for Electrical Engineers and contains a comparable profundity of well-organized reference information of both quantitative and qualitative nature. Of interest to power generation engineers will be the following typical additions, gas turbines, atomic power, reflective heat insulation, superalloys for high temperatures, automatic process control, heat pumps, solar and radiant heating, vapor-compression distillation. There is little one cannot find here whether it be the holding power of a nail, the supporting power of a concrete foundation or the lifting power of a jet-engined airplane.

Microwaves

Propagation of Short Waves. **By Donald E. Kerr, et al. Published by McGraw-Hill Book Co, New York 18. 728 pages, illustrated. Price $10.**

This is another in the MIT radiation laboratory series and is directed at the propagation between terminal points. Like the others it is a resumé of the state of the art and much of the subject matter of interest to communication engineers on power systems can well be the varying reception under varying meteorological conditions. It analyzes in this bracket the radar echoes from precipitation, surface heating and rising currents, sea breezes. The refraction is treated along with the reflections.

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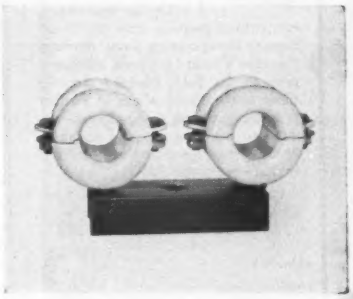

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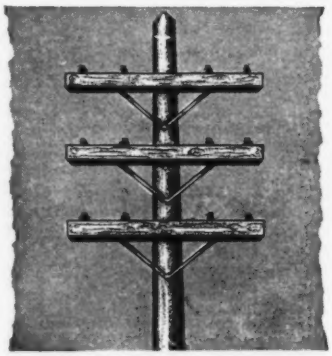

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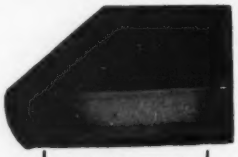

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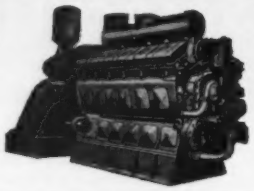

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1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
937.5	General Motors	12-567	1080	720	312	Clark	MD-4	375	327
625	Alco	6-12½x13T	750	600	125	Ingersoll Rand	S	225	514
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1	625	Westg	Non-cond. 125 lbs. I.S.P. 5/20 lbs. B. P. 440 v. 3 ph. 60 cys.
1	400	Westg.	Non-condensing—125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.

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	KVA	Make	Type	Volts	Speed
1	5140	Whse.		2400/4160	600
1	4000	G.E.	TSC	2400/4160	900
1	3000	Whse.		2400/4800	750

MOTOR GENERATOR SETS

3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
2	2000	G.E.	600	666 25 cy	11000
1	1800	G.E.	600	125/250	2300/4160
1	1500	G.E.	360	375	2300/4600
1	1000	Whse.	900	600	4160
1	1000	G.E.	900	600	2300/4160
1	750	G.E.	900	275	4160
1	750	Whse.	900	275	2300/4160
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300
1	400	G.E.	720	250	440/2300
1	350	G.E.	900	125	4160

TRANFORMERS—60 Cycle

	KVA	Make	Type	Ph	Voltages
2	4000	G.E.	HT	3	22000x2300
3	2666	Whse.	OISC	1	66000x11000
3	1320	G.E.	BVDDJ	1	6600x2400
3	833	Pitts.	OISC	1	26400x2900
6	250	G.E.	HT	3	13200x240/480
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3	3333	West.	132000—7620/13200 Y
1	2000	G.E.	69300—13800/23900 Y, 3 ph.
3	1000	West.	66000—7200
3	200	Mol.	44,000/22,000—440/220
3	75	G.E.	44000—2300/4600
3	8333	West.	43800—13900
4	6667	G.E.	38100/66000Y—12700/22000Y
6	150	G.E.	34500—4600/2300
2	7500	A.C.	33000—13200, 3 ph.
6	200	G.E.	33000—2300/6900
4	150	G.E.	33000—7200/12470
6	75	Mol.	33000/16500—2300/6900
3	75	Weg.	33000—7200/12470 Y
1	7500	G.E.	26400—612, Rectifier type
4	450	A.C.	25410/44000—13280/23000
3	750	West.	13200—440
3	333	G.E.	13200—240/480
3	333	G.E.	11000/22000—2400
3	200	Mol.	11000—2300
3	333	G.E.	4160—240/480
3	250	G.E.	4160—240/480
1	1500	West.	4000—2300, 3 ph. Auto
3	500	G.E.	4000—2300
3	200	A.C.	2400—120/240

INDUCTION REGULATORS

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3—46 KVA West. 200/400 A. 2300 V.
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LETTERS TO THE EDITOR

Hard Hat History

To the Editor:

This refers to the article contained in the January 22, 1951 issue of "Electrical World," page 3. . . . "A Massachusetts utility man reminisces that in the early days of the industry a trouble-shooting lineman would never climb a pole without a derby on his head. The hard hat was considered insulation against electric shock."

You will pardon me for differing with you, for I too recall the day when "the dice box" made up the head gear for a lineman. In fact, in lieu of such head dress for the present day, we require our linemen to wear a large-brim high crown hat.

Sport caps and the like have become quite common since the return of our boys from the service five years ago. We realize that these offer no protection, but space or distance does . . . and if a person is wearing proper head protection he at least is warned before it is fatal.

Edward C. Hunt
Safety Engineer
Pacific Gas and Electric Co
San Francisco

(Editor's Note: Safety wears many hats. From this particular standpoint we might expect Texas linemen to be the safest of all.)

Engineering Not Attractive

To the Editor:

Your editorial "Glamorize the Engineer" is all very true but I doubt if it will affect the hard-shelled utility operators very much. It is indeed gratifying to the writer to read so many editorials about the scarcity of engineers. They have been kicked around and exploited for so long that they need a decade of prosperity.

Gentlemen of the medical profession don't go around lamenting the scarcity of doctors. They like it and deliberately plan for it by drastically limiting the enrollment in their schools of medicine. As a result their standard of living is high, about twice that of engineers, and they have no trouble interesting high school students in their profession. . . . .

With the average 1950 farm income in this country of $11,000 and small merchant and semi-skilled workers' incomes equally high it is no wonder the youngsters are not interested in engineering. Such a career means five or six years of hard work with the prospects of being a small cog in a large corporation at a small salary.

This state is full of graduate engineers who are in business for themselves all the way from bottling soft drinks to real estate salesmen. It would be my guess that in the future those hiring engineers are going to have to pay them what they are worth and provide better working conditions.

B. E. Ellsworth
302 South Maple
North Platte
Nebraska

Getting Back to Earth

To the Editor:

I could not believe that so many errors could exist in one one-column ¾-in. item ("Electrical World," March 19, pg 29.) In the first place it is E A R T H, Texas, not Erath. As a matter of fact, the plant is located between Earth and Amherst. The customer contact on this job, if that is what is meant by c/c, is our plant design engineer, E. W. Robinson, whose address is 3rd & Polk Streets, Amarillo, Texas.

H. O. Hodson
Vice President-Operating Mgr
Southwestern Public Service Co
Amarillo, Texas

(Editor's note: In this case, "Electrical World's" report was out of this wrold.)

Planned Wiring Popular

To the Editor:

I thought you might be interested in knowing that, following the appearance of the wiring story in "Electrical World" (Feb. 12, 1951, pg 114), we have received numerous requests for copies of our check lists, pictures, newspaper advertisements, ideas, suggestions and comments. Among requests received lately from power companies and electrical associations are: One each from the East and South, two from the southeastern United States, and three each from the Midwest and Southwest; a total of ten.

We are always happy to receive these inquiries and to oblige by sending the requested material. We feel that if we can interest others in taking a more extensive part in promoting planned wiring, a lot of the benefits will gravitate back into our territory. The wider the promotion the easier our job becomes with our own customers.

Joseph M. Mooney
Wiring Consultant
Louisiana Power & Light Co.
New Orleans 14, La.

Electric House Heating

To the Editor:

Your statement (Technical Notes, Jan. 22, 1951) that electric house heating takes from 0.25 to 0.33 kwhr per degree day per 1,000 cu ft has aroused our curiosity. We would like to know the source of this information, and the basis for the derivation of these factors.

We have obtained data from a number of house heating installations in our territory. The corresponding factors which we obtained varied from 0.43 to 0.7. Another point which confuses us is the lack of consistency in these factors with regard to type of construction or degree of insulation.

Further, our results have been confirmed by test data on nine cases in the territory served by the Potomac Electric Power Co. The corresponding factor for these cases varied from 0.31 to 0.668. Because of this experience, we would like to know if any company has obtained data from actual installations which verify the factors mentioned in your notes.

W. W. Clouse
Industrial Power Department
Consolidated Gas Electric Light and Power Co of Baltimore

(Editor's Note: Data cited in the Technical Note item was based on information given to "Electrical World" by Niagara-Mohawk Power Corp on experience in the Buffalo area.)

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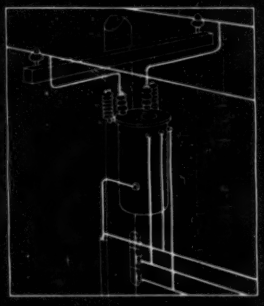

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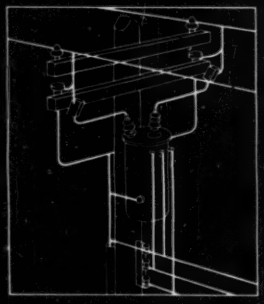

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